JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

APRIL, 1855.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Description of McLaughlin's Patent Self-acting Railway Car Brake.

By H. Howson, C. E.

Railroad machinery has presented few such fertile subjects for the speculative schemes of theorists, as well as for the practical experiments of engineers, as that of car brakes. In support of this assertion, we have only to peruse a list of patents, dating from the time when railroad traveling had become somewhat general. That so much inventive talent should have been expended on this subject, will cease to be a matter of astonishment, when we reflect on its vast importance. The increased speed of railway trains and the necessity of repeatedly stopping the same, above all, the numerous and fearful accidents, which have, in too many cases, occurred through the inefficient machinery for retarding their progress, have all combined to render this a favorite subject for the consideration of the ingenious. That the means of stopping and retarding railway trains should be under the control of a single individual, is acceded to by all who are versed in railroad tactics. To effect this object, it becomes necessary that the braking apparatus of all the cars should be in some way connected together and rendered continuous throughout the whole train. In many instances, the tendency of the cars to be pressed against each other by their momentum in a partially retarded train, has been tried as a means of applying the rubbers to the wheels. The devices for this purpose have been both numerous and ingenious, but all, more or less complicated and deficient in the all important feature of durability, re-

sulting in that want of success, to which the present almost universal use of the ordinary hand brake bears ample testimony.

A self-acting car brake, continuous throughout the whole train and at the same time under the individual control of the engineer, has been invented and put into practice by Mr. T. G. McLaughlin of this city, and has been secured by letters patent both in this country and in England.

Simple and inexpensive in its construction, as well as efficacious in its results, this apparatus may, as one which has stood the severe test of time, as well as the scrutiny of experienced engineers, be declared the most successful automatic car brake hitherto introduced, and as such, is well worthy of the attention of railway companies and the traveling public.

The invention was alluded to in the January number of this *Journal*, in partially mistaken terms, however, which the following description of the accompanying engraving (Plate II,) will tend to rectify. The latter has been prepared from working drawings furnished to the writer by the patentee, and is illustrative of his braking apparatus, as attached to the cars of the Camden and Amboy, North Pennsylvania, and West Chester Railroads.

Fig. 1, is a ground plan of the frame-work of an ordinary passenger car.
Fig. 2, the same of the back of the tender or brake van.
Fig. 3, a partial elevation of Fig. 1.
Fig. 4, the same of Fig. 2; and
Fig. 5, an inverted plan, to an enlarged scale, of the levers and rods for communicating motion from the sliding bar to the brake levers.

Underneath the frame-work of each car, is the sliding rod B, which is forked at each end for the purpose of clearing the king joints of the truck C. The sliding rod is supported on small rollers, suspended from the frame at suitable intervals in such a manner that it shall have a longitudinal movement only. When not in operation, (as shown in the engraving,) the forked ends of the rod B, project beyond the ends of the car frame, but not beyond the bumpers, as described in a recent number of this *Journal*, the amount of projection being such, that the cars may be brought together without the ends of the sliding rod of one car coming in contact with those of the next, when not acted upon by the apparatus on the tender hereafter referred to. To the middle of the frame-work is secured the bracket D, on a pin attached to which works the horizontal lever E. To the latter, and at equal distances from its centre, are jointed the rods G and H, the slotted ends of which slide on pins secured to and projecting from the under side of the sliding rod B. To the same lever E are likewise jointed the rods K, which are connected to the brake levers L of each truck. These brake levers, together with the rubbers M and spring connecting rod N, are of the ordinary construction, and such as are generally used in conjunction with the ordinary hand apparatus.

On a small shaft working in bearings at the back of the tender or brake van, are secured the two arms O, corresponding in their distance apart with the forked ends of the sliding bar. These arms are allowed to have a radial movement, as shown in dotted lines (fig. 4,) that movement being given by the lever Q on the same shaft as the arms O and the ver-

T. M°LAUGHLIN'S
PATENT SELF-ACTING CAR-BRAKE.

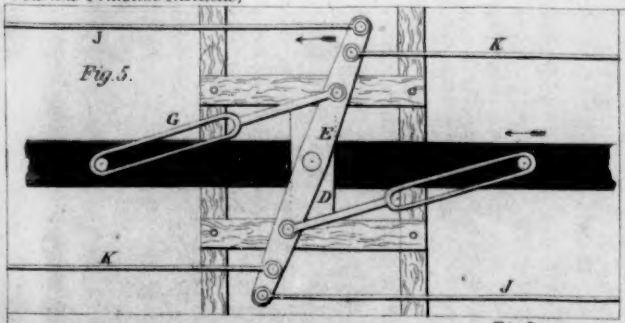

Fig. 5.

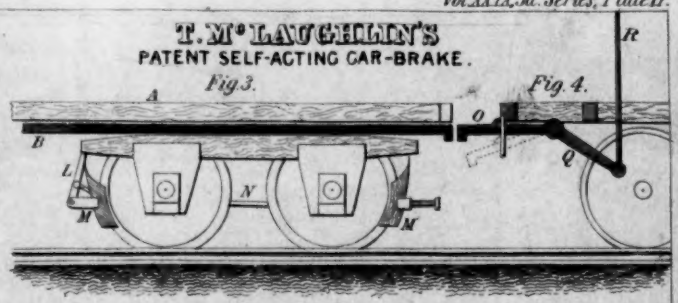

Fig. 3. Fig. 4.

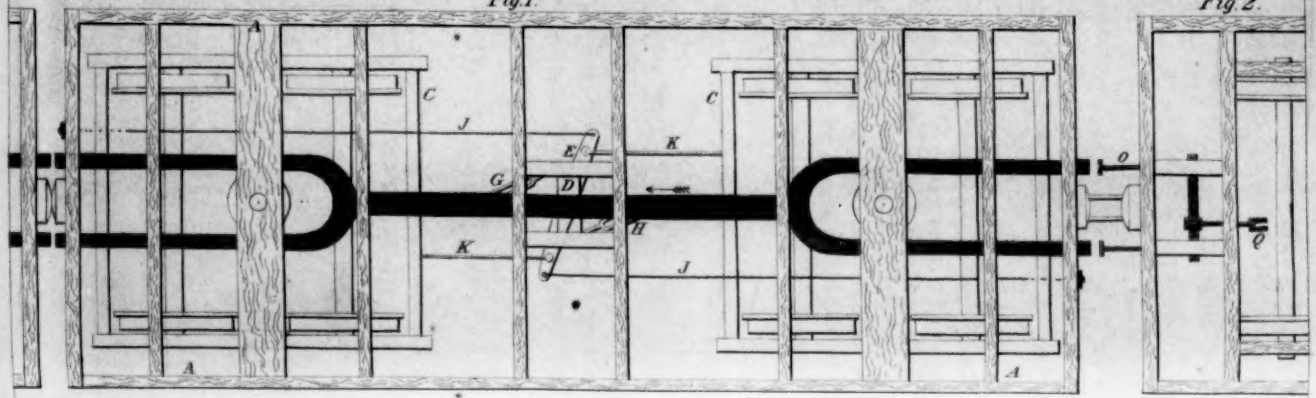

Fig. 1. Fig. 2.

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tical rod R, which is under the control of the attending engineer and brakesman.

Now supposing that the cars are in motion and that it be required to stop the same, the rod R is depressed by the attendant, and consequently the arms O raised to a horizontal position, so that their ends may coincide with the forked ends of the sliding rod B. The steam being now shut off from the engine, and the latter thereby partially retarded, the car will be urged with considerable force towards the tender, thereby bringing the sliding rod in contact with the ends of the arms O, and giving the former a movement in the direction of the arrows to a distance corresponding to the amount of projection of the arms O beyond the bumper of the tender. The rod G, which has the end of its slot in contact with the pin on the sliding rod, will have a simultaneous movement, thereby turning the horizontal lever E in the direction of the arrow, and through the rods K and levers L applying the rubbers to the wheels of both trucks.

Each car being furnished with apparatus similar to that above described, the movement is communicated throughout the whole train, and the brakes of every car put into efficient operation by the simple act of raising the arms O. Should the sliding bar be forced in a direction contrary to that pointed out by the arrow, the slotted rod H, would be the means of communicating motion from the sliding bar to the lever E, when a similar application of the rubbers to the wheels would take place, so that whichever end of the cars should chance to be nearest the tender, the same result will take place, without the necessity of making any alteration in the machinery.

To the extreme ends of the lever E are attached the rods J, which communicate with the ordinary windlass situated at each end of the car, so that the brakes can be applied by hand at pleasure without disturbing the sliding bar or rods G and H. The expense of furnishing a car with the above described apparatus, and applying it to the ordinary brakes, does not exceed thirty-five dollars, and the success which has hitherto attended its introduction on the above mentioned roads, has induced other companies to treat with the inventor concerning its adoption on their own line.

For the Journal of the Franklin Institute.

Disquisition on the Laws regulating the Slips of Screw Propellers in function of Form and Dimensions; based on a Digest of the Experiments made in 1845 *by M. Bourgeois, Engineer de Vaisseau, at the French Government Manufactory at Indret.*

By B. F. Isherwood, Chf. Eng. U. S. N.

(Continued from page 163.)

Of the Influence exerted on the Slip of a Polybladed Screw, by fractioning the Pitch by the successive omission of Blade after Blade.

To determine the influence exerted on the slip of a screw composed of a certain number of blades, by successively omitting blade after blade, and disposing the remaining ones at equal distances around the axis, two complete sets of experiments were made on two different screws. One

screw, which I shall call A, was divided into five blades, and had a pitch of 19·69 inches. The other screw, which I shall call E, was divided into seven blades, and had a pitch of 27·56 inches. The other dimensions of both screws were the same; they had straight generatrices and directrices, were full threaded, and composed of one convolution of the thread. As the object of these experiments was to determine only the effect on the slip by the successive omission of blade after blade, the positive dimensions of the screw are immaterial, and in order to have the results strictly comparable, they are only given from the *same face of the same blades*. The material of these screws was wrought copper beaten *very thin*.

Screw A had the following dimensions, viz:

Diameter,	15·75 inches.
Diameter of hub,	2·95 "
Pitch,	19·69 "
Length in direction of axis,	3·94 "

I have taken the experimental slips given by this screw with the different number of blades, and laid them off by scale as ordinates to a curve, whose corresponding abscissæ are represented by the number of the blades; a fair curve being then passed so as to join the greatest number of points, or to pass as much above one point as below another, will, I conceive, give results that can vary from the truth but in a trifling degree. The following table contains these and the experimental slips corresponding to the successive number of blades employed:

Number of blades.	Fractions used of the pitch.	Number of double courses ran.	Projected area on a plane at right angles to axis, in square inches.	SLIP.			Ratio of the slips by the curves proportionably.
				Mean slip of the screw in per centums of its speed, by the experiments.	Minimum and maximum slip of the screw in per centums of its speed, by the experiments.	Slip of the screw in per centums of its speed, by the curve.	
5	5-5 or 1·0	2	188	30·4	30·4 30·4	30·4	1·0000
4	4-5 or 0·8	6	150	31·7	30·3 33·9	31·5	1·0362
3	3-5 or 0·6	3	113	33·0	31·9 33·7	33·9	1·1151
2	2-5 or 0·4	2	75	38·7	38·3 39·2	38·2	1·2566
1	1-5 or 0·2	2	38	45·3	45·1 45·5	45·3	1·4901

Screw E had the following dimensions, viz:

Diameter,	15·75 inches.
Diameter of hub,	2·95 "
Pitch,	27·56 "
Length in direction of axis,	3·94 "

With this screw, which was composed first of seven blades, similar experiments were made as with the screw A, by successively omitting a

blade, and placing the remaining ones at equal distances around the axis. In order to have the results strictly comparable, those from the same face of the same blades only have been taken and grouped in the following table, together with the slips as determined by the curve described in the same manner as with screw A:

Number of blades.	Fraction used of the pitch.	Number of double courses ran.	Projected area on a plane at right angles to axis, in square inches.	SLIP.			Ratio of the slips by the curve, proportionably.
				Mean slip of the screw in per centums of its speed, by the experiments.	Minimum and maximum slips of the screw in per centums of its speed, by the experiments.	Slip of the screw in per centums of its speed, by the curve.	
7	7-7 or 1·000	3	188	35·9	{ 35·1 } { 37·4 }	36·2	1·0000
6	6-7 or 0·857	3	161	37·0	{ 35·9 } { 37·8 }	36·3	1·0028
5	5-7 or 0·714	2	134	37·1	{ 36·9 } { 37·3 }	36·8	1·0166
4	4-7 or 0·571	5	107	38·1	{ 37·3 } { 38·7 }	38·1	1·0525
3	3-7 or 0·429	3	81	41·8	{ 41·7 } { 42·1 }	40·8	1·1271
2	2-7 or 0·286	3	54	45·9	{ 45·4 } { 46·1 }	45·7	1·2624
1	1-7 or 0·143	3	27	53·0	{ 52·5 } { 54·0 }	53·0	1·4641

It will be observed, that the results by the curves in the two tables, though from screws of different pitch and number of blades, offer a very close agreement, the curves being, in fact, almost identical; which will appear by commencing in the last table with the slip as unity given by five blades, and comparing the ratio of increase of slip as the blades are successively omitted, with the same ratio in the first table, as follows, viz:

Ratio of the increase of the slips by first table.	Ratio of the increase of the slips by last table.
1·0000	1·0000
1·0362	1·0351
1·1151	1·1087
1·2566	1·2418
1·4901	1·4402

An experiment was tried on screw H, by reducing its number of blades from 7 to 5, and placing the five at equal distances around the axis. Also on screw T by reducing the number of its blades from 7 to 4, and placing the four at equal distances around the axis. Screw T was composed of zinc; screw H was composed of wrought copper beaten *very* thin, and

both were full threaded. The following are the dimensions of these screws, viz:

	H.	T.
Diameter, .	13·62 inches.	15·75 inches.
Diameter of the hub,	2·95 "	2·95 "
Pitch, .	24·25 "	35·43 "
Length on axis, .	3·46 "	3·39 "
Generatrix, .	straight.	Straight and tangent to an inner cylinder, the blades being inclined 100° and 80° to the plane of the axis.
Directrix, .	straight.	Curved, the angle of the tangents with the chord being 8°.

The following table contains the results, viz:

Designation of the screw.	Number of blades.	Fraction used of the pitch.	Number of double courses ran.	Projected area on a plane at right angles to axis, in square inches.	Mean slip of the screw in per centums of its speed, by experiment.	Maximum and minimum slips of the screw in per centums of its speed, by experiment.
H	7	7-7 or 1·000	2	139	35·7	35·4 / 35·9
	5	5-7 or 0·714	1	99	36·6	—
T	7	2-3 or 0·667	5	125	31·4	27·9 / 33·0
	4	0·381	7	72	32·7	29·5 / 34·3

Experiments were made with other screws, alike in all respects, except that the number of the blades was 14 and 7; also, with still other screws alike in all respects, except number of blades, which was 20 and 10. In these experiments one convolution of the thread was always used, and the screws of half the number of blades had a double length in the direction of the axis, presenting, of course, the same area of projected surface; the object being to ascertain if the slip was affected by the arrangement of the *same* surface into a more or less number of blades; but the results, which were in some cases almost identical, and in other cases widely varying, determining nothing in function of such an arrangement of the surface.

In experimenting on screws A and E by the successive omission of blade after blade, it was found, that the trepidations of the screw, or knockings at the stern of the boat, were *very great* when a *single* blade was used. When *two* blades directly opposed were used, the trepidations became *light*. When *three* blades placed equally around the axis were used, the trepidations became *nearly insensible;* and with *four* blades, entirely *ceased.*

Of the influence exerted on the Slip of a Polybladed Screw by Fractioning the Pitch by the successive diminution of the Length of the Screw by the passage of a Plane across it at right angles to Axis.

A complete set of experiments was made to determine the increase of the slip of the screw, by successively removing portions of its length by passing a plane across it at right angles to the axis. The screw F, on which these experiments were made, was full threaded, and at first composed of one convolution of the thread; the generatrix and directrix were straight, and the material was wrought copper beaten very thin. The screw was of the following dimensions, viz:

Diameter,	15·75 inches.
Diameter of the hub,	3·94 "
Pitch,	31·50 "
Length on axis,	3·94 "

With this screw the experiments were made in the following manner, viz: It was first experimented with using the whole convolution of the thread and a length of 3·94 inches; this length was then successively diminished by one-seventh, the number of blades, of course, remaining constant. The following table contains the result of each diminution of length, to which I have added a column of results derived from a curve formed by laying off with a scale the slips for ordinates and the corresponding lengths of screw for abscissæ, and passing a fair curve through them: these results from the curve I believe to be very nearly correct.

Number of blades.	Fraction used of the pitch.	Length of the screw, in inches.	Number of double courses ran.	Projected area of the screw on a plane at right angles to axis, in square inches.	SLIPS.			Ratio of the slips by the curve.
					Mean slip of the screw in per centums of its speed, by experiment.	Minimum and maximum slips of the screw in per centums of its speed, by experiment.	Slip of the screw in per centums of its speed, by the curve.	
8	7-7 or 1·000	3·94	3	183	31·5	33·5 / 35·4	35·0	1·0000
"	6-7 or 0·857	3·38	"	157	35·7	34 6 / 37·1	35·7	1·0200
"	5-7 or 0·714	2·81	"	130	38·0	37·5 / 38·8	37·0	1·0571
"	4-7 or 0·571	2·25	"	104	38·9	38·6 / 39·6	38·6	1·1029
"	3-7 or 0·429	1·69	"	78	38·7	38·3 / 39·4	44·0	1·1714
"	2-7 or 0·286	1·13	"	52	45·2	44·8 / 45·5	44·2	1·2629
"	1-7 or 0·143	0·56	"	26	49·2	48·2 / 50·0	50·0	1·4286

The experiments we have cited on screws E and F, which screws are sufficiently near alike for this purpose, enable us to determine the relative effect produced on the slip by equal diminutions of surface, whether made by the omission of blades or by the diminution of the length of the

screw. The surface in both screws was first one convolution of the thread, and then diminished successively by one-seventh at a time ; the diameters and original lengths of the screws were the same, the number of blades (7 and 8) were nearly the same, the pitches were as 1·000 and 1·143, and the slips varied but little. It is clear, then, that the results are fairly comparable. They are as follows, viz :

E. (Surface reduced successively one-seventh by the omission of blade after blade.)	F. (Surface reduced successively one-seventh by the repeated diminutions of the length of the screw.)
Ratio of the increase of the slips.	Ratio of the increase of the slips.
1·0000	1·0000
1·0028	1·0020
1·0166	1·0571
1·0525	1·1029
1·1271	1·1714
1·2624	1·2629
1·4641	1·4286

It will be perceived from the above figures, that the influence exerted on the slip of the screw by diminutions of its surface, is sensibly the same, whether equal amounts of diminution be made by omitting blades, retaining the same length of screw, or by reducing the length of the screw, retaining the same number of blades; and this result has been confirmed by other experiments. The following, which is the mean of the above ratio, may be taken, generally, as the—

Ratio of the increase of the Slip from fractioning the Pitch successively one-seventh, that is to say, by successive reductions of one-seventh of the Surface.

Fractions used of the pitch.	Ratio of the increase of the slip.
7-7 or 1·000	1·0000
6-7 or 0·857	1·0024
5-7 or 0·714	1·0369
4-7 or 0·571	1·0777
3-7 or 0·429	1·1492
2-7 or 0·286	1·2626
1-7 or 0·143	1·4463

If, in the above table, we compare the increase of slip resulting from halving the surface, we shall find the ratio of that increase to be about the same, let the absolute amounts of surface taken be what they may: for instance, let us compare the ratio of the slips obtained from using the fractions one-seventh and two-sevenths of the pitch,—from using two-sevenths and four-sevenths of the pitch,—and from using three-sevenths and six-sevenths of the pitch, and we shall obtain the following results, viz :

Fractions used of the pitch, representing relatively surfaces of 1 and 2.	Ratio of the slips, taking the slip with the half surface as unity.
1-7 and 2-7	1·146
2-7 and 4-7	1·162
3-7 and 6-7	1·146
Mean,	1·151

From the above we find, that within the limits of one convolution of the thread and with the same screw, halving the surface either by reducing the length one-half, preserving the same number of blades, or by omitting one-half the number of blades, preserving the same length, increases the slip in the ratio of 1·151 to 1·000, or two-thirteenths; and this ratio is constant for all surfaces whose areas compare as 1 and 2, be the absolute extent of those surfaces what they may. For example, if using six-sevenths of one convolution of the thread give a slip of 30 per centum, then using three-sevenths of the same convolution will give a slip of $(1{\cdot}151 \times 30 =)$ 34½ per centum; if using two-sevenths of one convolution give a slip of 39 per centum, then using one-seventh of the same convolution will give a slip of $(1{\cdot}151 \times 39 =)$ 45 per centum, and so on.

An experiment was tried with screw c, to determine the increase of slip resulting from a diminution of the length of the screw one-half by a plane passing at right angles to axis; other things remaining the same. This screw was full threaded and was originally composed of convolution of the thread; the generatrix and directrix were straight, and the material was wrought copper beaten very thin. The dimensions of the screw were as follows, viz:

Diameter, ...	15·75 inches.
Diameter of hub, ...	3·94 "
Pitch, ...	23·62 "
Length in direction of axis, . .	3·94 "

The results will be found in the following table, the same face being used to propel with:

Number of blades.	Fraction used of the pitch.	Length of the screw, in inches.	Number of double courses ran.	Projected area of the screw on a plane at right angles to axis, in square inches.	SLIPS.	
					Mean slip of the screw in per centums of its speed, by experiment.	Minimum and maximum slips of the screw in per centums of its speed, by experiment.
6	6-6 or 1·00	3·94	3	188	28·5	28·1 32·0
"	3-6 or 0·50	1·97	"	94	34·5	33·4 35·7

Of the Influence exerted on the Slip of the Screw by placing the blades checkerwise.

An experiment was made to determine, whether any influence would be exerted on the slip by taking half the number of blades comprising the screw, and disposing them immediately behind the remaining half checkerwise, or in such a manner that the rear blades equally divided the spaces between the front blades. This arrangement, of course, just doubled the length of the screw, and, also, doubled the width of the

spaces between the blades. The screw experimented with had the following dimensions, and the same face of the blades was used throughout.

Diameter,	15·75 inches.
Diameter of hub,	3·94 "
Pitch,	23·62 "
Length in direction of axis,	1·97 "
Number of blades,	6.
Fraction used of the pitch,	0·50.
Projected area of the screw on a plane at right angles to axis,	94 square inches.
Generatrix and directrix,	straight.

With the above screw three double courses were ran, giving slips of 33·4, 34·3, and 35·7 per centums: *mean slip* 34·5 *per centum.*

Three of the original six blades were then taken out, and placed as before described, checkerwise, immediately behind the remaining three, making the length of the screw in direction of the axis 3·94 inches. Three double courses were again ran, giving slips of 34·0, 34·9, and 35·8 per centums: *mean slip* 34·9 *per centum*, or the same as before.

No influence was, therefore, exerted on the slip of the screw by the checkerwise arrangement of its blades.

It will be observed, that these experiments amount to precisely using the same surface, but in one case dividing it into 6 blades, and in the other case dividing it into only 3 blades, but each blade of double length; and the result exactly corresponds to the conclusion previously arrived at, from a comparison of the effect produced on the slip by decreasing the number of blades, preserving the same length of screw, or by decreasing the length of the screw, preserving the same number of blades; the surface of the screw being always kept constant, viz: that the slip of equal amounts of the same screw surface continues the same, whether that surface be divided into few or many blades.

General Tables 1st and 2d, containing Comparable Experiments on Various Screws.

The data given in the following tables, 1st and 2d, are believed to be accurate and fairly comparable throughout; it has been selected from a large mass after a careful revision. With some of these screws other experiments were made to determine single points, and although the slips were then sometimes not quite consistent with what are here given, and not absolutely true, yet they were, doubtless, comparatively correct for the circumstances under which they were made, which circumstances being the same and at the same time, the *comparative* results can be confidently accepted. The slips from the screws of the fourth series, table 2d, are a very little too small *comparatively* with the screws of the other series of tables 1st and 2d, owing to the greater stiffness of their blades, resulting from their smaller diameter.

TABLE I.—*Containing the Data and Results of Experiments on Full-threaded Screw composed of one Convolution of the Thread, with straight Generatrices and Directrices.*

Series.	Designation of the screw.	DIAMETERS. Diameter of the screw in inches.	DIAMETERS. Diameter of the hub in inches.	Pitch of the screw in inches.	Ratio of the pitch to the diameter of the screw, the diameter being unity.	Number of blades of the screw.	Length of the screw in the direction of the axis, in inches.	Area of the screw projected on a plane at right angles to axis, in square inches.	Number of double courses ran.	SLIPS. Mean slip of the screw in per centums of its speed.	SLIPS. Minimum and maximum slips of the screw in per centums of its speed.
1st	A	15·75	3·94	19·69	1·25	5	3·94	183	3	23·7	22·8 24·7
	B	"	2·95	"	"	"	"	188	2	24·6	23·6 25·6
	C	"	3·94	23·62	1·50	6	3·94	183	3	28·5	28·1 29·2
	D	"	"	27·56	1·75	7	"	"	5	32·6	32·0 33·1
	E	"	2·95	"	"	"	"	188	14	32·7	25·4 37·4
	F	"	3·94	31·50	2·00	8	"	183	3	35·6	34·7 36·7
	G	"	"	35·43	2·25	9	"	"	3	41·7	41·3 42·9
5th	H	13·62	2·95	24·25	1·78	7	3·46	139	2	35·7	35·4 35·9

TABLE II.—*Containing the Data and Results of Experiments on Part-threaded Screw composed of one Convolution of the Thread, with Straight Generatrices and Directrices.*

Series.	Designation of the screw.	DIAMETERS. Diameter of the screw in inches.	DIAMETERS. Diameter of the interior of the blade, in inches.	Pitch of the screw, in inches.	Ratio of the pitch to the diameter of the screw, the diameter being unity.	Number of blades of the screw.	Length of the screw in the direction of the axis, in inches.	Area of the screw projected on a plane at right angles to axis, in square inches.	Number of double courses ran.	SLIPS. Mean slip of the screw in per centums of its speed.	SLIPS. Minimum and maximum slips of the screw, in per centums of its speed.
2d	I	15·75	7·875	15·98	1·015	14	1·14	146	2	20·9	20·7 21·0
	J	"	"	22·84	1·450	10	2·28	"	2	31·3	31·0 31·6
	K	"	"	27·56	1·750	14	1·97	"	2	37·8	37·7 37·9
	L	"	"	39·37	2·500	10	3·94	"	2	52·6	52·3 52·9
3d	M	15·75	11·81	39.37	2·500	10	3·94	85	3	63·4	61·8 65·2
4th	N	12 28	5·91	30·71	2·500	10	3·07	91	2	60·3	59·9 60·7
	O	"	"	21·50	1·750	14	1·54	"	2	43·6	43·1 44·1

Of the influence exerted on the Slip of the Screw by the length of its Pitch.

In order to determine the influence exerted on the slip of the screw by the length of its pitch, the data in tables 1 and 2, can be employed; the screws of the first, second, and fourth series being comparable with those of their own series;—and for this purpose the "ratios of the pitches" will be compared with the "ratios of the slips," as in the following table, viz:

Series.	Designation of the screw.	Pitch of the screw, in inches.	Slip of the screw in per centums of its speed.	RATIOS. Ratio of the pitches.	RATIOS. Ratio of the slips.	Series.	Designation of the screw.	Pitch of the screw, in inches.	Slip of the screw in per centums of its speed.	RATIOS. Ratio of the pitches.	RATIOS. Ratio of the slips.
1st	A	19·69	23·7	1·000	1·000	2d	I	15·98	20·9	0·700	0·668
	B	19·69	24·6	1·000	1·038		J	22·84	31·3	1·000	1·000
	C	23·63	28·5	1·200	1·203		K	27·56	37·8	1·207	1·208
	D	25·56	32·6	1·400	1·376		L	39·37	52·6	1·724	1·680
	E	27·56	32·7	1·400	1·380						
	F	31·50	35·6	1·600	1·502	4th	N	30·71	60·3	1·429	1·383
	G	35·43	41·7	1·800	1·760		O	21·50	43·6	1·000	1·000

If in the above table, we compare the columns of the "ratios of the pitches" and of the ratios of the corresponding slips, we shall find them to offer so very close an agreement, that we are warranted in considering it experimentally established, that the slips of screws, similar in other respects, are in the direct ratios of their pitches; that is to say, doubling the pitch doubles the slip.

Of the influence exerted on the Slip of the Screw by cutting out the inner portion of the Blades.

The influence exerted on the slip of the screw by cutting out the inner portion of its blades, by the passage through it of a cylinder with an axis coincident with the axis of the screw, can be determined by a comparison of the slips of the screws of series first in table 1, with those of the screws of series 2d and 3d in table II.

In the first place, the determination will be made for a cutting out of the inner part of the blades, by the passage of a cylinder whose diameter equals half the diameter of the screw; and for this purpose the screws of series 1st are compared with those of series 2d, but, in order to make this comparison, inasmuch as the screws of series 1st and 2d have different pitches, it is necessary to ascertain what would be the slips of the screws of series 2d if they had the pitches of the screws of series 1st; then, by taking the mean of all the slips of the screws of series 1st, and comparing it with the mean of the mean determination of the slip of each screw of series 2d, on the supposition that it had the pitch of the screw of series 1st, with which it was compared, we shall obtain, as determined by the mean of all the experiments, the increase of the slip of the screw due to this particular cutting out of the inner part of its thread.

The calculation of the slips that the screws of series 2d would have with the pitches of these screws of series 1st with which they are compared, has been made from these experimental slips, diminished or increased in the direct ratio that their actual pitches were less or more than the pitches of said screws of series 1st. The following table contains the results of the comparison between the screws of series 1st and 2d, viz:

SERIES 1st.		SERIES 2d. Slips which screws of series 2d would have with the pitches of screws of series 1st.	SERIES 1st.		SERIES 2d. Slips which the Screws of series 2d would have with the pitches of screws of series 1st.
Screw A. Slip 23·7	I	25·7	Screw F. Slip 35·6	I	41·2
	J	27·0		J	43·2
	K	27·0		K	43·2
	L	26·3		L	42·1
Mean,		26·5	*Mean,*		42·4
Screw C. Slip 28·5	I	30·9	Screw G. Slip 41·7	I	46·3
	J	32·4		J	48·5
	K	32·4		K	48·5
	L	31·6		L	47·3
Mean,		31·8	*Mean,*		47·6
Screw D. Slip 32·6	I	36·1			
	J	37·8			
	K	37·8			
	L	36·8			
Mean,		37·1			

The mean of the mean slips of the screws of series 2d in the above table is $\left(\frac{26{\cdot}5+31{\cdot}8+37{\cdot}1+42{\cdot}4+47{\cdot}6}{5}=\right)$ 37·1 per centum: the mean of the slips of the screws of series 1st in the above table is— $\left(\frac{23{\cdot}7+28{\cdot}5+32{\cdot}6+35{\cdot}6+41{\cdot}7}{5}=\right)$ 32·4 per centum, difference, 4·7 per centum absolutely, or $\left(\frac{37{\cdot}1-32{\cdot}4\times100}{32.4}=\right)$ $14\frac{1}{2}$ per centum relatively of the slips of series 1st. Hence we find, that cutting out the inner part of the blades by the passage of a cylinder whose diameter equals half the diameter of the screw, increases the slip one-seventh; that is to say, if the slip of the full threaded screw were 28 per centum, the slip of the same screw when cut out as above, would be 32 per centum.

In the second place, the determination will be made for the cutting out of the inner part of the blades by the passage of a cylinder whose diameter is three-fourths the diameter of the screw; and for this purpose the screws of series 1st will be compared consecutively with screw M of series 3d. This comparison, made as in the first case, gives the results contained in the following table, viz:

SERIES 1ST.		SERIES 3D.	
Screws.	Experimental slips.	Screws.	Slips which screws of the 3d series would have with the pitches of the screws of the 1st series.
A	23·7	M	31·7
C	28·5	"	38·0
D	32·6	"	44·4
F	35·6	"	50·7
G	41·7	"	63·4
Mean,	32·4	*Mean,*	45·6

The mean of the slips of the screws of series 1st in the above table is 32·4 per centum; the mean of the slips of the screw M of series 3d is 45·6 per centum; difference 13·2 per centum absolutely, or—

$\left(\frac{45{\cdot}6-32{\cdot}4\times100}{32{\cdot}4}=\right)40{\cdot}8$ per centum relatively of the slip of series 1st.

Hence, we find, that cutting out the inner part of the blades by the passage of a cylinder whose diameter equals three-fourths of the screw, increases the slip two-fifths; that is to say, if the slip of the full threaded screw were 28 per centum, the slip of the same screw, when cut out as above, would be 39 per centum.

Again, the determination of the effect exerted on the slip of the screw by cutting out the inner part of its blades by a cylinder whose diameter equals 0·481 of the diameter of the screw, can be made by comparing the results of screw H, series 5th, table I, with the results of the screws of series 4th, table II; the slips will be made comparable by modifying those of series 4th in the direct ratio of the pitch and in the ratio of the square of the diameter of screw H as hereinafter shown, which screw is selected for comparison because its diameter and pitch are but little different from those of the screws of the 4th series. The results will be found in the following table, viz:

SERIES 5TH.		SERIES 4TH.	
Screw.	Experimental slip.	Screws.	Slips which screws of the 4th series would have with the diameter and pitch of the screw of the 5th series.
H	35·7	N	38·9
"	"	O	40·1
		Mean,	39·5

The mean of the slips of the screws of 4th series is 39·5 per centum in the above table, the slip of screw H is 35·7 per centum; difference, 3·8 per centum absolutely, or $\left(\frac{39{\cdot}5-35{\cdot}7\times100}{35{\cdot}7}=\right)10{\cdot}7$ per centum relatively of the slip of screw H. Hence we find, that cutting out the inner part of the blades by the passage of a cylinder whose diameter equals 0·481 of the screw, or twelve-twenty-fifths, increases the slip two-nineteenths; that is to say, if the slip of the full threaded screw were 28 per centum, the slip of the same screw would be 31 per centum.

(To be Continued.)

Translated for the Journal of the Franklin Institute.

Composition of Betons not attacked by Sea Water. Researches of M. Vicat and Son.

The difficulty of compounding in the moist way, double silicates of alumina and lime, capable of absolutely resisting sea-water, induced my son and myself to endeavor to form double silicates of magnesia and alumina in the same way. We have succeeded beyond our hopes in very numerous cases, and under certain conditions easily realizable as to the chemical composition of the pozzolanes to be employed, and with proportions of magnesia far less than those of the lime used in such cases.

If it were then possible to obtain magnesia at a price available in public works, the problem of the formation of inattackable betons would be resolved. According to the opinion of M. Balard, one of our learned chemists, and a member of the Academy, the mother-waters of salt marshes, of which no use is made, might furnish this base at the desired price.

We hope that the publicity given to this note may induce the companies who own our salt-works to try this extraction of magnesia. The chemical processes which will have to be applied on a large scale, we theoretically know.—*Acad. Sciences, Paris, November*, 1854.

Extract from the Seventh Annual Report of the Ohio and Pennsylvania Railroad Company, Pittsburgh, January 25, 1855.

"A drought of uncommon intensity and duration diminished very much the crops along the line, and the delay in the opening of the Ohio and Indiana Railroad to Fort Wayne, which did not take place until the first of November, deprived the road of a portion of its anticipated business.

"Notwithstanding these circumstances, the earnings of the road in the year 1854, after deducting the sums received for other companies, have been $1,111,626·18. The earnings in 1853 were $668,004·49, and the increase has been $443,621·69, *or more than* 66 *per cent.* This is a striking fact, of the most encouraging character, in estimating the value of the line.

"The transportation expenses and repairs have amounted to $499,508·87, being about forty-five per cent. of the gross earnings, and the net

earnings have been $612,117·31—being about eleven per cent. on the cost of the road, with its present equipments—whilst more than half of this cost is represented by bonds, bearing seven per cent. interest and having a long time to run.

"The Board think that the Stockholders have great reason to be satisfied with the regularity, safety, and success with which the road has been worked, and with the amount of its earnings during the past year."

For the Journal of the Franklin Institute.

Railroad Crossing of the Hudson River at Albany. By Edward W. Serrell, Civ. Eng.

For many years past the difficulties that have been experienced at this point, to the great lines of travel that centre here, have called loudly for some more adequate and suitable method of crossing than has existed.

If perpetual summer reigned, the annoyances would be but trifling, comparatively; but the changes of the seasons bring so many conditions that are burthensome, that it has long been considered as of the utmost importance to the traveling and commercial public, that some method should be adopted and brought into use, by which this break of the lines should be avoided.

Various plans have been suggested, and from time to time the legislature has been petitioned for a charter authorizing the construction of bridges of different descriptions.

The New York Central Railroad, and the Boston and Albany Railroads descend into the Valley of the Hudson at this point more or less abruptly, and the Hudson River Railroad lies near the level of the stream.

The banks on either side are moderately steep, but if the interests of the communities above Albany on the river, would agree to it, the physical obstacles in the way of bridging could readily be overcome, and at such cost as would be very remunerative.

Even in the summer time very great delay is experienced at the ferry, both to passengers and the mails—freight is diverted, and ascends the stream, crossing the river at Troy, and descends on the easterly side towards Boston or New York—but in the Spring of the year, during floods, and before the ice has formed sufficiently at the commencement of winter, and very frequently during the periods of thaws, the river opposite Albany is for days, and sometimes weeks together, quite impassable.

But the question arises, what plan can be adopted that shall supply the requisite facilities without interfering with the navigation, and shall not encroach upon the vested rights of the people living upon the upper waters of the stream ?

Drawbridges of several kinds have been planned, but none, so far, seem unobjectionable, at least the legislature has not authorized any of them to be built as proposed. Either the height above the water, the insufficiency of the passage way, the obstruction to the stream, the sedimentary deposits which it has been supposed would be formed, or the ice jams that were feared, or the effects of wind currents produced, or some other real

or imaginary difficulties have thus far, together with local prejudices and personal interests, which no doubt have had their weight, prevented the execution of any plan whatever.

It has been proposed to *tunnel* under the bed of the river, and such a project may be feasible, but this plan is, also, surrounded with difficulties.

The contiguity of the steep slopes of the valley to the river, makes it more than questionable, whether such *lines* can be obtained that in other respects would be desirable or even admissible, upon which suitable *gradients* can be had for entering and leaving such a work.

The great cost of tunneling in the material here met with, and under the existing physical circumstances, cannot be doubted; but even this might be no more than the business to be done would warrant, if other things were favorable.

Cannot some one suggest a plan that shall meet all the requirements and be free from all objections? Is there not engineering talent enough in the country to devise means that shall give to the railroads a suitable crossing without interfering with the navigation of the river? Cannot a plan be presented in such a plain and positive manner that all will agree to it? Surely it can be.

It must be conceded on all sides that this is by far the most important place upon any line in America, that admits of an unbroken connexion; local prejudices would doubtless give way before an adequate device. Some plan must, sooner or later, be adopted; this is a good field for enterprising talent.

Passage of the first Locomotive over the Suspension Bridge over the Falls of Niagara.

To the Committee on Publications.

The First Locomotive passed over the Niagara Suspension Bridge yesterday, at a moderate speed. This engine, weighing 23 tons, caused a slight depression of the superstructure, which, in the centre, measured 3½ inches, but produced no vibration whatever. The experiment was repeated to-day with two other engines, making separate trips at a speed of 8 miles per hour. One of these weighing 34 tons, and with a well filled passenger car attached, caused a depression in the centre of 5½ inches.

Considering the unfinished state of the work, the above results, and the total absence of vibration, are highly gratifying. The success of the work may be considered as established. The strongest gales have no effect on it. The Bridge will be open for the regular passage of trains in about eight days.

JOHN A. ROEBLING.

March 9, 1855.

AMERICAN PATENTS.

List of American Patents which issued from January 30th, to February 27th, 1855, (inclusive,) with Exemplifications.

JANUARY 30.

185. For an *Improved Implement for Boring Wells;* I. J. W. Adams, Sharptown, Md.

Claim.—"The employment or use of the spring attached to the handle of the swinging or suspended auger, and arranged with a knob or projection on its outer surface, which knob or projection catches into a cavity in the under surface of the bail, for the purpose of holding the auger in its proper position while being operated."

186. For an *Improvement in Clarifying Glue;* Wm. Adamson, Philadelphia, Pa.

Claim.—"The employment of the ordinary calcined and ground plaster of paris, or that superfine quality of it, known in commerce under the name of 'terra alba,' for the purpose of clarifying glue, gelatin, size, &c."

187. For *Hot Air Furnaces;* Abel H. Bartlett, Kings' Bridge, New York.

Claim.—"In combination with the arrangement of the serpentine fire and air flues or courses, providing each horizontal flue with an escape casing or jacket, connected by branch or otherwise, (each horizontal casing,) with a gas pipe or pipes uniting them with the chimney. The arrangement of the fire flues and air heating passages, traversing at right angles to each other, when combined with division plates, or their equivalents, so arranged that the one stratum or current of air to be heated passes upwards throughout the several hot air passages or channels in a serpentine course, similar to but at right angles with the course given the flame, simultaneously passing upwards in the fire flues, over, under, and between the hot air passages or flues."

188. For a *Car Ventilator;* B. T. Babbitt, City of New York.

Claim.—"The arrangement of a wind wheel, in connexion with a wire gauze disk or screen, revolving in a tank of water, the air passing through the said disk previous to entering the car."

189. For an *Improvement in Seed Planters;* John Blackwood, Franklin County, O.

Claim.—"The additional hopper to catch the seed which falls off of the slide after it passes the brush."

190. For an *Improvement in Seed Planters;* Job Brown, Lawn Ridge, Illinois.

Claim.—"The combination of the cups, placed obliquely on a rotating cylinder, with the distributing plates."

191. For a *Fountain Brush;* Dexter H. Chamberlain and J. Hartshorn, Boston, Mass.

Claim.—"Arranging or applying the brush, the valve, its rod and the socket tube together, so that not only shall the brush be fixed directly to the valve, and be movable backward and forward, and around with and by it, but the socket be made to so encompass the valve and brush that the marking fluid may flow down around the external surface of the brush before penetrating into its interior. So combining with the slide and the fountain, a mouth tube open at both ends, that such tube may not only serve to enable a person to supply the reservoir with paint or marking fluid, but also to enable him to move longitudinally, or rotate the rod and its valve and brush. The float, in combination with the opening at the inner end of the tube, and so arranged to move on the slide rod and within the tube, and to operate therewith."

192. For an *Improvement in Ploughs;* Alfred Doe, Concord, New Hampshire.

Claim.—"Two separate furrow-boards, arranged to vibrate perpendicularly, independent of the point and share, so as to turn alternately right and left furrows on level or inclined land with equal facility, operating in combination with a swivel point and shares, arranged to vibrate under the land side with the body or front portion of the furrow-boards. In combination with the swivel point, shares, body, and one of the furrow-boards mentioned in the above claim, a sub-furrow-board, arranged to vibrate perpendicularly, so constructed as to turn a sub-soil furrow in one direction upon the top of the furrow just ploughed in one direction, and a sub-soil in the other."

193. For an *Improvement in Dies for Cop Tube Machines;* James Eaton, Townsend Harbor, Massachusetts.

Claim.—"Consists in so securing the step to the die that it may at any time be dressed off and again brought up to place. The method described, of securing the step to the die."

194. For a *Double Acting Force Pump;* George Fowler, Northford, Connecticut.

Claim.—"The combination of the solid piston with the cylinder and reservoir, when the piston is inserted from the lower end of the cylinder, and worked by a parallel side rod or shaft outside of the cylinder, (whether for single or double acting pumps,) so as to constitute an efficient lifting pump, (without suction valves.")

195. For an *Improvement in the Yoke of Shirts;* Hezekiah Griswold, Hartford, Conn.

Claim.—"Consists in applying to the upper part of a shirt, a compound or graduated yoke, said compound yoke being composed of two parts or sections, and made with two or more points, which being inserted, thereby expand the form, graduating the shape of the yoke and shirt to correspond with the form of the body. The compound yoke."

196. For an *Improvement in Clover Hullers;* Jonathan Hibbs, Tullytown, Penna.

Claim.—"Combining with the concave shell two flanches diverging from a central point, and so acting as to divide the chaff from the fresh fed straw during the time that the former is passing a second time round the cylinder."

197. For an *Improvement in Piano Fortes;* Alexander Hall, Lloydsville, Ohio.

Claim.—"Sinking the middle octave bridge below the level of the normal strings, so as to be clear of their vibrations. In combination with the depressed bridge, the perforations in the bridge, on the level with the top of the bridge. The extra hitch-plate, in combination with the depressed bridge and perforated bridge. The adjustable bridge-pin for the normal strings, furnished with a screw and the notches and channels on its two sides, so that the normal strings can be regulated in their relative distances from the octave strings, either vertically or laterally, or both. Making the buff stop of two qualities of leather, a hard and a soft, for producing the harp effect."

198. For an *Improvement in Rain Staff Screws for Ship Carpenters;* John Hobbs, Hallowell, Maine.

Claim.—"The arrangement of the screw stems passing through the rain staff, the sharp threaded screws forced into the timber or side of the vessel by the lever inserted in the aperture and the nuts, moved by the lever to force the rain staff towards the vessel, together with the set-down on each screw, for the purpose of inserting wedges between it and the edge of the plank, to bring the plank into place for spiking on the side of the vessel."

199. For an *Improvement in Carriage Wheels;* Washburn Race and Birdsill Holly, Seneca Falls, New York.

Claim.—"The compressed tenon, in combination with the annular cavity."

200. For an *Improvement in Augers;* Russell Jennings, Deep River, Connecticut.

Claim.—"So constructing the cutting edges of a double twist auger bit that the vertical scores shall follow the chisel, *i. e.*, so that the cutting edges of scores and chisel shall never intersect the worm or helix of the shaft at the same point."

201. For an *Improvement in Locking Spindle Door Latches;* William H. McNamee, Philadelphia, Pennsylvania.

Claim.—"The guides and the rim of the escutcheon, the shelf on the face plate, and the upright stem inclosed with a spiral wire working through the shelf piece. Also, the projecting arm on the spindle, and the forked bolt."

202. For an *Improvement in Machinery for Felting Hat Bodies;* Sidney S. Middlebrook, James B. Blakeslee, and Charles F. Blakeslee, Newton, Connecticut.

Claim.—"The employment or use of the two bed plates, corrugated on their inner surfaces, the upper bed or plate having an up and down and also a lateral vibratory movement given it by the cams, or their equivalents, and the lower bed being elastic or yielding, for the purpose of subjecting the hat bodies to a rolling motion under a requisite pressure."

203. For an *Improvement in Sewing Machines;* John B. Nichols, Lynn, Mass.

Claim.—"The combination of a binding guide with a sewing machine, meaning to claim the combination of mechanism whereby the operations of directing or applying the binding to the edge of any material, and sewing it thereon, are conducted by an automatic process."

204. For an *Improvement in the Construction of the Frame of Grass Harvesters;* A. Palmer, Brockport, New York.

Claim.—"Connecting the wheel, the cutter beam, and the tongue to the frame, in such manner that the frame operates as a lever, of which the axle of the wheel is the fulcrum, and by which means the cutter beam rises and falls independent of the wheel, thereby adapting itself to undulating surfaces, and by which means the draft of the team holds the cutter beam snug to the ground, thereby causing the machine to cut close and smooth."

205. For an *Improvement in Lantern Frames;* Elijah F. Parker, Proctorville, Vt.

Claim.—"Passing the guard wires of lantern frames through suitable holes in the corners or uprights, by which means soldering at such points may be dispensed with."

206. For an *Improvement in Cable Stoppers;* Jesse Reed, Marshfield, Mass.

Claim.—"The arrangement of the lever, the crank, and the upper jaw, whereby the latter is allowed to accommodate itself to the varying size of the links, and the operation of stopping the chain is adjusted by the friction of the chain itself upon the upper jaw."

207. For an *Improved Force Pump;* Henry Rogers, Ferrisburgh, Vermont.

Claim.—"The combination of the suspended valve bucket with the stationary hollow plunger, or of the suspended hollow plunger with the stationary valve bucket, when so constructed, arranged, and operated as to serve automatically to clear the delivery pipe of water."

208. For an *Improvement in Harvester Cutters;* David Russell, Drewersbury, Ind.

Claim.—"The combination of cutters with an endless chain or chains."

209. For an *Improvement in Portable Fire Arms;* Alexander O. H. P. Schorn, Murfreesboro', Tennessee.

Claim.—"The combination of the box, springs, and coiled spring, hammer and casing, when used in connexion with an external case."

210. For an *Improvement in Methods of Working Franklinite Ore;* Thaddeus Selleck, Greenwich, Connecticut.

Claim.—"The process of reducing Franklinite ore to obtain iron and the white oxide of zinc therefrom, by working it under a lighter head in a vertical walled low cupola furnace."

211. For an *Improvement in Carriage Wheels;* John Skelley, Brooklyn, New York.

Claim.—"Constructing the wheel as having a concentric ring or band constructed of wood, and secured by metallic bands on its sides, said ring or band being at any proper point between the hub and rim of the wheel, and having the half spokes secured between the rim and ring or band, and the whole spokes passing through said ring or band."

212. For an *Improvement in Straw Cutters;* G. L. Squier, Chicopee Falls, Mass.

Claim.—"The combination of the circular cutters or knives, and finger plates with the fingers attached to them, when said cutters and finger plates are secured the proper distance from each other on their shafts, by means of the rods and nuts."

213. For an *Improvement in Cultivator Teeth;* Joseph Stockdale, Ypsilanti, Michigan.

Claim.—"The reversible cast iron plate with the groove on the under side, round cast iron stay pin on upper side, and also the application of the top of the cultivator tooth in the groove aforesaid, and also the application of the wrought iron bolt or shank passing through the said plate."

214. For an *Improvement in the Construction of Furnaces for Zinc White;* Jonathan G. Trotter, Newark, New Jersey.

Claim.—"The use of the atmospheric air supply pipe, flues, heating chambers, and

series of apertures in the sides thereof, or substantially like parts, for the purpose of conveying into the oven a great number of infinitely small jets or blasts of heated atmospheric air, (independent of the blast of atmospheric air supplied through the ash pit of the furnace to support combustion,) for the purpose of more thoroughly consuming the gases from the ore and carbon."

215. For an *Improvement in Processes for Making India Rubber Cloth;* Henry G. Tyer and John Helm, New Brunswick, New Jersey.

Claim.—"The process of making elastic fabrics without a previous preparation of threads, strips, or sheets, or the coating of the cloth by cement."

216. For an *Improvement in Cylindrical Boxes;* Elisha Waters, Troy, New York.

Claim.—"Making the sides of said boxes of paper tubes, and the ends of wooden disks."

217. For an *Improvement in Waxing Thread in Sewing Machines;* Salem Wilder, Lynn, Massachusetts.

Claim.—"So applying the wax holder to the frame or arm of the machine, and between the needle and the eye of the needle carrier, that the vertical movements of the carrier shall cause the thread to be moved or drawn up and down through the wax holder and its elastic bottom, whereby the saturating of the thread becomes improved. Also, the combination of an elastic bottom or partition and its compresser with the wax holder, the same being to regulate the application of the wax to the thread, and to prevent its escape from the wax holder."

218. For an *Improvement in Sawing Machines;* Pinney Young, Milwaukie, Wis.

Claim.—"The employment or use of two pairs of guides secured to the ends of levers, and arranged so that said levers will be operated by the movement of the carriage, and each pair of guides brought alternately in contact with the saw near its cutting edge, the levers being operated simultaneously with the reversing movement of the carriage, for the purpose of allowing the saw to be properly guided or stayed while cutting in either direction. The combination of the toothed wheels, arms, or levers and pawls attached to plates, the arms, plates, and pawls forming a clutch, and so arranged as to operate the wheels and rotate the screw shafts, for the purpose of properly setting the log or timber to the saw, the movement of the wheels being regulated by adjusting the pins on the segments, or in an equivalent way, so as to give the required set to the log or timber."

219. For an *Improvement in Spurs;* James S. Ewbank, Assignor to Wm. Everdell, Jr., City of New York.

Claim.—"The construction of a spur having a divided hinge branch for embracing the heel of the boot or shoe. Also, the mode of sustaining the divided branches by means of the shoulder screw nut, either as constructed by having said nut with its bearing outside of the hinge of the jaws, or as sustained by means of the cone."

220. For an *Improvement in Delivering Apparatus of Grain Harvesters;* Edmund A. Morrison, Laurenceville, Assignor to self and Robert J. Morrison, Richmond, Va.

Claim.—"In combination with an endless conveying belt, with rakes thereon, and the weighted or spring door, the inclined flanch on said door under which the grain is carried and compressed, until the rake teeth come against said flanch, when the door is forced upwards on its hinges, and the cut grain delivered in compact bundles."

221. For a *Window Washer;* George A. Meacham, City of New York.

Claim.—"The arrangement of a sponge or brush at the end of a hollow handle or tube, connected by a hose or pipe to a body of water higher than the object to be washed, so that the water flows through the said sponge or brush at the very time it is rubbed or scrubbed against the window."

RE-ISSUE FOR JANUARY, 1855.

1. For an *Improvement in Mowing Machines and Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"The combination of the bar that supports the cutter with a diagonal lever held down at its inner end, and resting upon the axle of the carriage as a fulcrum, or

upon some other equivalent support that will perform the function of a fulcrum, whereby the outer end of the cutter bar is held up."

2. For an *Improvement in the Arrangement of Joints for Attaching Trucks to Harvester Frames;* John H. Manny, Rockford, Illinois.

Claim.—"The arrangement of a flexible joint in the line of the cutter, or thereabouts, in such a manner that the machine will bend freely up and down along this line to keep the cutter as nearly as may be at an uniform height from the surface of smooth or undulating ground."

3. For an *Improvement in Arrangements for Controlling Harvester Cutters;* John H. Manny, Rockford, Illinois.

Claim.—"Controlling the flexure of the machine, hinged so that it will bend in the line of the front edge of the cutting apparatus, or thereabouts, by means of an adjustable stop and arm, or their equivalents, in such manner that the cutter will be kept at the proper elevation on smooth ground, will be free to rise and fall, to conform to a gently undulating surface, and will be restrained from descending into furrows, or other sudden and narrow depressions, while it will be free to rise to any extent required for passing over boulders, stumps, or other like protuberances in its path."

4. For an *Improvement in Harvesters having a Leading Truck;* John H. Manny, Rockford, Illinois.

Claim.—"The leading carriage to carry the driver in a position in advance of the cutter, where he can readily see obstructions, and observe the character of the surface of the ground in time to adjust the machine properly for operating upon any given part of its path before reaching the same, in combination with a cutter carriage joined to the leading carriage by a hinged bar or other flexible connexion, the cutter carriage being provided with an adjusting lever or arm, and extending forward to the leading carriage, where it can be conveniently reached by the driver, to enable him to raise and lower the cutter, as required."

5. For an *Improvement in the Frame Construction of Triangular Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"Constructing the frame which supports the cutting apparatus of a triangular or trapezoidal form, one of its acute angles being at the end of the finger bar next the standing grain, so that the frame will not bear against the standing grain back of the finger bar, and will permit the wheel, which supports the outer end of the platform, to be placed a considerable distance within the end of the finger bar, yet sufficiently far from the frame, and at the same time not too far back of the centre of weight to poise or balance the machine properly."

6. For an *Improvement in Cutter Fingers of Harvesters;* J. H. Manny, Rockford, Ill.

Claim.—"Constructing the lower part of the finger, or the upper, or both, with a recess on either side in front of the finger bar, whereby the clogging of the cutting apparatus is effectually prevented. Also, constructing the finger so that the sides of its upper half will overhang those of its lower half, the cutter playing between the two. Also, beveling the upper corners of the shank of the lower part of the finger, so as to form a cutting edge thereon."

7. For an *Improvement in Harvesters;* John H. Manny, Rockford, Illinois.

Claim.—"1st, The arrangement of the track scraper at the outer end of the machine, and the wheel or wheels which support the opposite end of the machine, whether driving wheels or not, in such relative position that the wheels, while the machine is cutting one swath, will run in the track cleared by the former, while the machine was cutting a previous swath." 2d, The projection on the under side of the upper bars of the top of the finger, in combination with the chamfer or recess on the lower inside corners of said bars, to counteract the tendency of wire grass and other fibrous obstructions to pass in between the cutter bar and the sides of the recess in the upper part of the finger in which it is guided. 3d, Forming the guard finger of two parts interlocked at the point, so that grass cannot lodge in the joint and form an impediment to its entering between the stalks of the standing grain. 4th, In combination with the raker's stand or seat, I claim the removable platform or raking bottom, constructed with a wing that extends from the outer end of the cutter over the frame, and holds up the butts of the straws above the stubble, which otherwise would obstruct the discharge of the grain from the platform."

8. For *Improvements in Spark Arresters;* J. Radley and J. W. Hunter, City of N. Y.

Claim.—"1st, The arranging of a series of chambers and channels between two conically shaped plates, the channels being so formed as to cause the products of combustion to impinge against that side of each of the dirt chambers which has the openings and caps, and thereby force the sparks, dirt, &c., into them. 2d, The piece suspended in the central aperture at the top of the spark arrester. 3d, The double cover or top for the formation of a second series of dirt passages."

9. For an *Improvement in Ploughs;* Cornelius R. Brinckerhoff, Batavia, New York.

Claim.—"1st, Combining with the plough beam, between the plough and the forward end of the clevis, by means of a single shaft, two wheels, one on each side of the beam, and of different diameters, the one resting in the furrow and the other on the land. 2d, Making the tread of the furrow wheel narrow. 3d, Making the furrow wheel beveling outward on the side which presses against the land. 4th, Making the small wheel adjustable, with reference to the shaft or axle and the large wheel. Also, the adjustable hangers, in combination with the plough beam and axle, for the combined purpose of bracing the axle and rendering the wheels simultaneously adjustable with reference to the beam, without disturbing their adjustment."

10. For an *Improvement in Fastening Lanterns;* Chas. Monnin and Wm. M. Booth, Buffalo, New York.

Claim.—"Attaching the lamp to the lantern, by means of the combination of the catches, with the flanches and the ring to which the catches are hinged, or its equivalent, to give the hinged ends of the catches a motion concentric or parallel, or nearly so, to the side of the lantern, or the flanch through which the catches pass."

DESIGNS FOR JANUARY, 1855.

1. For *Parlor Stoves;* James Wager, Volney Richmond, and H. Smith, Troy, N. Y.

Claim.—"The ornamental design and configuration of parlor stove plates."

2. For a *Cooking Stove;* Garrettson Smith, Henry Brown, and Joseph A. Reed, Assignors to J. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief, on the plates of the cook stove 'Emporium.'"

3. For a *Parlor Cook Stove;* Garrettson Smith, Henry Brown, and Joseph A. Read, Assignors to J. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief for a parlor cook stove."

4. For *Stoves;* Garrettson Smith, Henry Brown, and Julius Holzer, Assignors to J. G. Abbott and A. Lawrence, Philadelphia, Pennsylvania.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief, of the stove 'Fanny Fern.'"

5. For *Lanterns;* Wm. D. Titus, Brooklyn, New York.

Claim.—"The ornamental figures on the sunken planes or faces, the beads at the sides or edges of the planes or faces, and the ornamental figures on the upper parts of the sides of the lantern."

6. For *Metallic Coffins;* M. H. Crane, Assignor to Crane, Reed & Co., Cincinnati, O.

Claim.—"The ornamental design for a metallic burial case."

7. For *Parlor Open Front Stoves;* N. S. Vedder, Troy, N. York, Assignor to G. F. Filley, St. Louis, Missouri.

Claim.—"The ornamental design and configuration of parlor stove plates."

8. For *Parlor Stoves;* N. S. Vedder and E. Ripley, Troy, New York, Assignors to G. F. Filley, St. Louis, Missouri.

Claim.—"The ornamental design and configuration of parlor stove plates."

9. For *Coal Stoves;* C. Harris and P. W. Zoiner, Cincinnati, Ohio.

Claim.—"The ornamental design for a parlor coal stove, to be known and called the 'Diadem.'"

FEBRUARY 6.

1. For an *Improvement in Smut Machines;* John Bean and Benjamin Wright, Hudson, Michigan.

Claim.—"Supplying air to the fan of a separator, the shoe of which is arranged in connexion and at right angles with a smut machine, by causing said air to pass through the smut scourers and revolving screens of said smut machine, on its way to the fan."

2. For an *Improvement in Double-Acting Force Pump;* W. C. and J. S. Burnham, City of New York.

Claim.—"Having the casing cylinder and passages arranged as shown, and cast in one piece, and secured upon the upper part of a base or circular chamber, having compartments within it, and valves upon its top plate, arranged and communicating with the several passages."

3. For an *Improvement in Manufacturing Seamless Felt Goods;* John H. Bloodgood, City of New York.

Claim.—"The method of forming the various parts necessary to the production of seamless articles of felt, by the use of a movable or stationary pattern."

4. For an *Improved Daguerreotype Plate Holder;* D. N. B. Coffin, Jr., Lynn, Mass.

Claim.—"The peculiar combination and arrangement of the block frame and bed piece."

5. For an *Improved Lifting Jack for Moving Rail Cars;* Nelson B. Carpenter and John Powers, City of New York.

Claim.—"The improved jack, constructed as herein shown, viz: connecting two ordinary screw jacks by a frame provided with an arch, and having a slide fitted on the upper part of the frame, the slide being connected to the frame, as herein shown, and operated by a horizontal screw, for raising and adjusting railroad cars upon the track, and other analogous purposes."

6. For *Current Water Wheels;* Richard Deering, Sr., Louisville, Kentucky.

Claim.—"The concave flanched screw, in combination with the conical body or centre. Also, the arrangement of hanging the water wheel, and other machinery in framing, adjustably connected with the vessel or scow, whereby they may be raised or lowered."

7. For an *Improvement in Axle Box Rollers;* G. W. Geisendorff, Indianapolis, Ind., and Jacob C. Geisendorff, Cincinnati, Ohio.

Claim.—"The giving a positive motion or rotation to the lubricating roller by the axle of the car wheel."

8. For an *Improved Corn and Cob Crusher;* John S. Griffith, Huntingdon, Penna.

Claim.—"The combination of platform, holders, and knives, arranged with the crushing frustrums and concaves."

9. For an *Improved Wire Cloth Flour Bolt;* F. B. Hunt and Elias Nordyke, Richmond, Indiana.

Claim.—"The peculiar means for graduating the pressure of the brushes against the wire cloth of the bolt, viz: the loose hubs on the shaft being attached by arms to slides which work on the outer sides of the stationary arms, the outer ends of the slides being attached to the brush bars, which fit in the forked ends of said arms, the hubs by being moved on the shaft expanding or contracting the brush bars, the hubs being secured in the proper position by the rods."

10. For an *Improvement in Elliptical Rotary Pumps;* B. Holly, Seneca Falls, N. Y.

Claim.—"The corrugated grooved pistons or cogs."

11. For an *Improved Burglar's Alarm;* David Haldeman, Morgantown, Va.

Claim.—"Combining with the trigger lever or dog which holds the hammer at a cock, a hinged inclined lever, the end of which simply passes underneath the door, and requires no fastening other than it receives by being held by the door itself, as it is pushed open."

12. For an *Improved Machine for Repairing Roads;* A. Kimball, Fitchburg, Mass.

Claim.—"The Machine for making and repairing roads, consisting essentially of the combination of the plough and scraper suspended from the lever. Pivoting the rear axle and securing it to the frame work, in a position oblique to the direction of motion."

13. For an *Improvement in Pressing Hats and Bonnets;* S. E. Pettee, Foxboro', Mass.

Claim.—"The combination of the curved heated bed plate with the roller, for the purpose of pressing hats and bonnets, whereby I am enabled to use a rolling pressure, in contradistinction from a sliding pressure given by smoothing irons, or any other substantially the same."

14. For an *Improved Street Sweeping Machine;* Robert A. Smith and John Hartman, Jr., Philadelphia, Pennsylvania.

Claim.—"The arrangement of detachable receivers beneath the forward portion of the frame, suspended by chains attached to hooks on the receiver, from the pulleys and windlasses, so that an empty receiver may be substituted for a filled one with great facility, and the filled receiver removed by a tender. Also, constructing the rear portion of the inclined plane with wheels or rollers, and tail-piece of loose sections, so that the rear of the machine may rest on the ground, and conform to the inequalities of its surface. Further, the employment of the hinged stud, in connexion with the driving wheel and loose wheel, for operating the endless chain of brushes."

15. For an *Improvement in Steam Generators;* Wm. Mt. Storm, City of New York.

Claim.—"1st, Inclosing a thermostat in a steam-tight space, forming a part of the steam conducting passage to the engine, and from such thermostat forming an exterior and adjustable connexion to a cock or valve located in the exit pipe of the boiler in such manner that being moved by the thermostat, it shall direct more or less of the steam through the super-heater, the whole device for, by acting in conjunction thus controlling while being actuated by the temperature of the steam going to the engine. 2d, Regulating and tempering the heat in the desicator by the admission to it as may be necessary, of water from the boiler, by means of an especial communication, the quantity admitted being governable by the adjustment of a cock."

16. For an *Improved Crushing and Grinding Mill;* Joel Weigle, Swan Station, Pa.

Claim.—"Combining with the crusher and the grinder, the casings in such a manner that the said crusher and grinder can be adjusted in a longitudinal direction, and the casing of the crusher be adjusted in a lateral direction."

17. For an *Improvement in the Combined Chair and Crib for Children;* William B. Carpenter, City of New York.

Claim.—"The chair, in combination with the standards, and hinged thereto, when constructed and arranged so that by the reversal of the chair, the whole forms a high and low chair and crib for children."

18. For an *Improvement in Locomotive Trucks;* John Cochrane, Baltimore, Maryland.

Claim.—"The method of neutralizing or preventing the vibratory tendency of the trucks of locomotive engines, caused by the direct action of the forces which operate the truck driving wheels, by means of the steam or hydraulic brace."

19. For an *Improvement in Constructing Ships and other Vessels;* V. P. Corbett, Corbettsville, New York.

Claim.—"The arrangement of the india rubber, or elastic and water proof pad covering or lining on the back of the inside lining and bracing planking, and between the said inside planking and the stiffer or more solid outer timbers or frame work of the hull of the vessel, the same serving to form a stout elastic cushion or pad bearing for the inside planks to rest upon in their union to the outer frame work of the ship, and constituting a planked elastic pad inside casing to the vessel, for operation in the manner, for the better accomplishment of the several purposes of protection, freedom from injury, and facility of repair."

20. For an *Improvement in Steam Boilers;* Thomas Champion, Washington, D. C.

Claim.—"1st, Arranging an annular flue at the bottom of an upright boiler, for receiving the air at its mouth, and conducting it beneath the grate. 2d, Making the vertical tube in the form of a double cone, the upper cone being inverted, and the two united together at their apices."

21. For an *Improvement in the Manufacture of Paper Pulp;* H. Glynna, Baltimore, Md.

Claim.—"Introducing into the pulpy mass soluble soaps of wax or fats, made as set forth, converting the same into insoluble soaps within the pulp, by means of soluble salts, for the purpose of preventing forgery, mildew, and the action of insects, rats, and vermin."

22. For an *Improved Sounding Board for Piano Fortes;* J. A. Gray, Albany, N. Y.

Claim.—"The improvement of the sounding board of the piano forte, by corrugating its surface, thereby increasing its sounding surface, and giving it sufficient stiffness or strength without glueing cross bars on either side."

23. For an *Improvement in Grass Harvesters;* James H. Maydole and A. W. Morse, Eaton, New York.

Claim.—"The combination of the adjustable and controllable roller with a grass harvester."

24. For an *Improvement in Sewing Machines;* Isaac M. Singer, City of New York.

Claim.—"Imparting the feed motion to the needle to move the cloth or other substance, to determine the space of the stitches to be made therein by a feed hand, or its equivalent, receiving the required motion from the mechanism, and acting against the needle in close proximity to or in contact with the cloth."

25. For an *Improvement in Mop Heads;* James A. Taylor, Alden, New York.

Claim.—"The combination of the handle and the bars with the cord, or its equivalent."

26. For an *Improvement in Butter Workers;* J. M. Williams, Blanchester, Ohio.

Claim.—"A hollow cone, in combination with a conical roller working on its apex."

27. For an *Improvement in Grain and Grass Harvesters;* Cyrenus Wheeler, Jr., Venice, New York.

Claim.—"The combination of the double-edged cutters with the cutter bar, the braces, the vibrating cutters, and their shanks and projections, the circular ribs, the bolts, the springs, the holes, the ribs, the cavities, or their equivalents, the whole forming the cutting apparatus of the machine. The revolving or track rake, consisting of its frame, its wheel, shaft, pinions, shaft, (6), wheel, (5), teeth, apron, joint, and cap, or their equivalents."

28. For an *Improvement in Compositions for Bleaching and Stuffing Leather;* L. W. Fiske, Louisville, Kentucky.

Claim.—"The improved mode of bleaching and stuffing leather, by using the bleaching and stuffing compounds, made of the ingredients, or their equivalents, viz: clean water, sulphuric acid, dissolved alum, dissolved borax, common salt, sugar of lead, common chalk, muriatic acid, fine flour, gum tragacanth, and alcohol."

29. For an *Improvement in Working Liming Vats in Tanneries;* L. W. Fiske, Louisville, Kentucky.

Claim.—"Using a close covering for liming and unhairing vats."

30. For an *Improvement in Churns;* Hazen Webster, Ogdensburg, New York.

Claim.—"In combination with the rotary disk, that form of the agitator which occupies the central portions of the disk, and sweeps towards the circumference in a spiral shape with rounded angles, and is surmounted, towards the circumference, with one or more vertical brakers; and this I claim, whether used with or without the air passages."

31. For an *Improvement in Mechanism for Retaining Cars upon the Track;* George P. Ketcham, Bedford, Indiana.

Claim.—"The employment or use of arms applied to the axles of the trucks, the arm of each truck being supported by a rod."

FEBRUARY 13.

32. For an *Improvement in Clover Hullers;* James Allen, Trease's Store, Ohio.

Claim.—"The arrangement of the two tail-boards, in combination with the tailing screens, so arranged under the inclined board that it shall be out of the way of the blast, and yet deliver the seed into the main receptacle, and the tailings out at its side through the aperture, it being understood that the outer and inner tail-boards must be adjustable respectively with reference to the screens."

33. For an *Improvement in Machines for Chopping Meat and other Substances;* W. H. Allen, Lowell, Massachusetts.

Claim.—"Forming a machine for chopping meat and other similar substances, by attaching the chopping knives to a central rotary spindle, when this is operated by the combination of the cam and corrugated disk."

34. For an *Improvement in Hop Frames;* Thomas D. Aylsworth, Frankfort, N. Y.

Claim.—"In combination with the permanently arranged supporting cord or wire, the training cords or wires leading from the ground to said supporting wire, and connected thereto by a spring hook, or its equivalent, so as to be readily connected to or detached from the supporting wire. Also, in combination with the training cord, the inverted cup for turning down the top of the vine, and preventing it from entering the supporting wire."

35. For an *Improvement in Life Boats;* Hiram Berdan, City of New York.

Claim.—"The method of keeping the gunwale bars in place, when the boat is extended for service, by means of the notches which are made in the ribs to receive the said gunwale bars."

36. For an *Improvement in Cotton Gins;* Henry Clark, Newport, Florida.

Claim.—"The combination of a large grinding roller, either smooth or grooved, with a very small one, the latter driven and supported, as described, by the friction rollers and the large ginning roller, together with one or more stripping rollers and comb, for the purpose of removing cotton seed from the fibre."

37. For an *Improvement in Churns;* Edwin B. Clement, Barnet, Vermont.

Claim.—"The folding dasher, operating as described, viz: by working the crank forward and back it will open and fold the dasher, and describe the inside of the vessel."

38. For an *Improvement in Threshers and Cleaners of Grain;* George Daniels, Philadelphia, Pennsylvania.

Claim.—"1st, A skeleton cylinder, in combination with a cast iron bed plate. 2d, The four inclined planes placed each at an angle of forty-five degrees, and so as to leave an oblong opening between them for the passage of the grain and chaff to the receiving box. 3d, The blower case, the receiving box with its inclined plane at its end, arranged and combined on the outside of the box or body of the machine."

39. For an *Improvement in Stays for Articles of Dress;* John Dick, City of N. York.

Claim.—"The improvement in stays, as applied to articles of wearing apparel, consisting of two or more supporting pieces with a spring or springs applied to extend them."

40. For an *Improvement in Wharf Boats;* Henry T. Dexter, Zanesville, Ohio.

Claim.—"So constructing a wharf boat as that a turn-table may be conveniently located therein, upon which a dray may be driven and turned around, and so that freight may be delivered or received from any part of the boat without much handling."

41. For an *Improvement in Ploughs;* George Esterly, Heart Prairie, Wisconsin.

Claim.—"Casting the standard with raised portions, land side, and form lay, all in one piece, to be employed either with or without the projection."

42. For an *Improved Magazine Smoke Consuming Stove;* J. Esterly, Albany, N. Y.

Claim.—"Constructing the stove with openings for the admission of air to the burning fuel, at some point or points above the grate, including between said points and the grate, sufficient fuel for igniting at any one time."

43. For an *Improvement in Cracker Machines;* Phineas Emmons, City of New York.

Claim.—"The revolving intermittent bed plate, operated by means of an eccentric on a driving shaft, and the connecting rod, lever, pawls, and notched wheel in combination, and this I claim, whether the said intermittent bed plate be or be not combined with the endless band surrounding it, for the purpose of conveying away the cracker."

44. For an *Improvement in Spirit Levels;* Hampton W. Evans, Philadelphia, Penna.

Claim.—"The crescent-shaped sliding or adjustable stops and spring catch, in combination with the grooved disk and set screws, or their mechanical equivalents."

45. For an *Improvement in Steam Boiler Chimneys;* Asahel Fairchild, Ashland, O.

Claim.—"Connecting the chimney of a steam boiler furnace to the flue connecting breeching thereof, by means of a cylindrical joint arranged in such a manner that the chimney can be lowered into a horizontal position without producing openings in said joint, and also without closing the connexion between the chimney and the furnace flues."

46. For an *Improvement in Machinery for Felting Hat Bodies;* William Fuzzard, Newark, New Jersey.

Claim.—"The employment or use of the corrugated rollers placed in a swinging frame, in combination with the endless apron."

47. For an *Improvement in Rotary Ploughs;* John W. Haggard and George Bull, Bloomington, Illinois.

Claim.—"The arrangement and combined operation of the ploughs and semicircular way."

48. For an *Improvement in Weather Strips for Doors;* A. Hitchcock, Chicago, Ill.

Claim.—"The peculiar form of the elevated surface or plane, in combination with the V shaped groove, weather strip, and listing."

49. For an *Improvement in Sewing Machines;* George H. and Benjamin H. Horn, Brooklyn, New York.

Claim.—"1st, A hollow needle with an eye in the side to pass the thread. 2d, Opening the loop by means of forceps, thereby insuring that the loop is properly opened, and avoiding tangling of the thread. 3d, Drawing the shuttle through the loop by means of the eye, or its equivalent, on the end of said shuttle, thereby avoiding the risk of breaking the loop when the shuttle is forced through the same."

50. For an *Improvement in Ships' Standing Rigging;* Frederick Howes, Yarmouth Port, Massachusetts.

Claim.—"Forming the shroud and back stays, or other standing rigging, in one continuous piece, and conducting the rope of which they are formed alternately through proper guides aloft, and guides at the channels or chain plates."

51. For a *Method of Teaching Penmanship;* Wm. S. McLaurin, City of New York.

Claim.—"The employment of figures marked on or formed in the surface of a tablet, slate, or other surface, for the purpose of aiding the hand in guiding the point of a pen, pencil, or stylus, in retracing therewith the lines of the said figures an indefinite number of times, to train the hands of pupils in teaching them the art of writing."

52. For an *Improvement in Leather Splitting Machines;* Matthew H. Merriam, Chelsea, and Joseph B. Crosby, Stoneham, Massachusetts.

Claim.—"1st, The disk cutter, having a simultaneous rotary and reciprocating movement, as applied to machines for splitting leather, and other analogous purposes. 2d, Constructing the draft roller so that its increased circumferential velocity may be made to act more or less efficiently, as desired. 3d, The combination of the apron, bed, and draft rollers."

53. For an *Improvement in Grass Harvesters;* Robt. J. Morrison, Richmond, Assignor to self and Edwin A. Morrison, Lawrenceville, Virginia.

Claim.—"Constructing the cutter teeth, or blade and teeth, and the guard fingers, of three several plates of metal, all of similar form, and lying closely upon each other, the middle row of teeth being sharpened and stationary, while the upper and lower ones are vibrated, for the purpose of causing whatever slipping there may be in gathering in the stalks to be cut to come upon the fingers mainly, and thus protect the sharp edges of the cutters."

54. For an *Improvement in Lamp Extinguishers;* J. H. Noyes, Abington, Mass.

Claim.—"Attaching the caps or extinguishers to the wick tubes of a lamp, by means of rods secured to the said wick tubes, and in such a manner that the caps may be freely moved up and down the said rod, and applied to or removed from the top of the wick tubes."

55. For an *Improvement in Machines for Slaughtering Hogs;* Jefferson Parker, Louisville, Kentucky.

Claim.—"The arrangement of the elevating fingers and the chains with the operating levers, and with the scalding vessel and the scraping bench."

56. For an *Improvement in Garden Rakes;* S. N. and William F. Stillman, Leonardsville, New York.

Claim.—"The new manufactnre of garden rakes, viz: a rake having curved metal teeth inserted and fastened into the head."

57. For an *Improvement in Bridle Bits;* William D. Titus and Robert W. Fenwick, Brooklyn, New York.

Claim.—"The improvement in bits for stopping running horses, consisting in the application of pads, so arranged and controlled by a rein that at the pleasure of the rider or driver, they be made to close the horses' nostrils, and thereby check respiration."

58. For an *Improvement in Ploughs;* Ira Reynolds, Republic, Ohio.

Claim.—"The laterally extending shoulders drawn back against and somewhat between the two shoulders, *r*, *r*, in order to hold the point securely in place, and prevent the breaking of the shank near the shoulders in the operation of ploughing. Also, the arrangement of the reversible steel share, as secured to the face of the mould board, by means of a screw bolt inserted from the lower side, the female screw being formed in the steel share. Also, the reversible self-fastening coulter."

59. For an *Improvement in Steam Valves;* John Tremper, Philadelphia, Penna.

Claim.—"1st, The valve, composed of a ring without ports or passages in its sides, applied within a casing containing a fixed head or cup, and a passage or passages leading from one side to the other of the fixed head or cup. 2d, The guard ring, applied either with or without the lip, for the purpose of protecting the inlet side or end of the valve against the percussive effect of the rush of steam or other fluid at the commencement of the stroke of the engine."

60. For an *Improvement in Head Supporters for Railroad Cars;* J. N. Williams, Dubuque, Iowa.

Claim.—"The arrangement of head supporters in railroad cars, in such a manner that each pair of supporters, by reversing their positions, can be adapted equally well to either one of the two seats nearest to said supporters when the said seat has the rear side of its back turned towards the supporters. Also, the combination of the head supporters, the plates, the bar, and the cord, or their equivalents, in such a manner that the supporters can be placed in the proper position for supporting the heads of persons riding on either one of the two seats nearest to said supporters, or turned up and secured to the side of a car."

FEBRUARY 20.

61. For a *Machine for Feeding Paper to Printing Presses;* A. B. Childs and H. W. Dickenson, Rochester, New York.

Claim.—"The raising and delivering the sheets by means of the inward and outward current being produced and operating in one and the same trunk through one and the same slit or opening, by means of the fan, or its equivalent, trunk, valve, revolving trunk, and pipe, and aperture, and, in combination therewith, we claim the outward blast produced through the trunk, by the means set forth. In combination with the inward blast through the revolving trunk for raising the paper, the outward blast through the revolving trunk for separating the sheets. Also, the projecting trunk, in combination with the main trunk. Also, the combination of the regulating and supply valve with the shut-off valve."

62. For an *Improvement in Sewing Machines;* Edwin A. Forbush, Ashland, Mass.

Claim.—"Combining with the carriage the clamps and bearer, or mechanism which draws the needle through the work, a set of pincers made to firmly grasp the thread between the needle and the work, and to be so moved away from the work as to draw the thread firmly into it. And, in combination with the said machinery for holding the needle and drawing it through the cloth or work, I claim machinery or mechanism (viz the rotary shaft, the clamps, and the bearer, or their equivalents,) for rotating the needle, or turning or rotating it around one hundred and eighty degrees, or end for end, such

mechanism allowing me to make use of a common or ordinary needle made with one eye, and but one point. Also, the combining with the nippers and the vibrating arm, the carriages, the spring bolt, and contrivances for operating it, as set forth, the same being not only to draw the thread into the work with sufficient tension, but to do so under any change in the length of it. Also, the combination of the rotating bearer, the two needle clamps, and the vertical rotary shaft, as operating together for the purpose of holding, releasing, and reversing the needle, or turning it around. Also, to combine with the rotary bearer, and its clamps and shaft, or machinery for holding, releasing, and directing a needle into the work, a propeller operated or made to operate so as to force the needle into the work. Also, to combine with the spring nippers, or machinery for taking up the slack of the thread, and preventing entanglement of the thread while the carriages are being moved towards the work, the sliding carriage or mechanism for preventing the weight of the said spring nippers and their slide from being thrown upon the thread so as to break the needle or displace it while it is being turned around."

63. For an *Improvement in Bank Locks;* Frederick Denzler, City of New York.

Claim.—"The lever, in connexion with its spring lever, together with the dog acting upon the lever, said dog being actuated by the dog, E, for the purpose of preventing the fallar from being turned."

64. For an *Improvement in Chimney Safes;* George B. Clark, Leonardsville, N. York.

Claim.—"The smoke box or chamber, arranged in the chimney, and having dampers above, and a conical or other equivalently shaped receiver below the point or points of entry of the smoke."

65. For an *Improvement in Life-Saving Rafts;* Geo. Blanchard, Washington, D. C.

Claim.—"1st, The arrangement of the toggle or jointed levers in relation to the buoyant cylinders or floats, and the catches or locks, by which when let fall, the raft, by its own weight, is extended and locked, and made entirely ready for immediate use. 2d, The arrangement of the braces with the chains, in connexion with the floats or buoyant cylinders and jointed levers, for the better sustaining of the bed formed by the extended levers, and for the holding of the parts of the raft together in a sufficiently firm yet yielding condition to enable the raft to be a safe and well sustained life-preserving structure."

66. For an *Improvement in Metallic Springs;* Levi Bissell, City of New York; antedated August 20th, 1854.

Claim.—"The combination of the rigid bar and the thin metallic strap, with their extremities rigidly attached together."

67. For an *Improvement in Straw Cutters;* James H. Bennett, Bennington, Vt.

Claim.—"The use and arrangement of the double acting spring, in combination with the arrangement and beveled shape of the knife."

68. For an *Improved Mill Stone Dress for Hulling Rice;* C. R. Barnes, Owego, N. Y.

Claim.—"The method of dressing horizontal stones for hulling rice, the runner having curved furrows in connexion with or separate from straight furrows, and the bed stone having smaller curves drafted thereon."

69. For an *Improvement in Fluid Burners;* Yarnall Baily, West Chester, Penna.

Claim.—"The construction and arrangement of the heaters, in combination with the generator."

70. For an *Improvement in Screw Wrenches;* S. H. Noble, Westfield, Massachusetts.

Claim.—"The application of the spiral or other spring, the thumb-piece part, and the spring under the thumb-piece part, in such a manner to the common screw of screw-wrench, as to create a backward and forward self-adjusting motion of adjustable part of screw-wrench now in use."

71. For an *Improved Bullet Mould;* John S. Keith and John Brooks, Canton, Mass.

Claim.—"Combining with the mould plates the air and lead chambers, the passages, and a tube leading out of the chamber, and terminating above the level of the receiving space, above the upper mould plate. Also, the arrangement of the outer surface of either of the mould plates tangentially to the spherical or adjacent surfaces of its several matrices, or so that after the mould has been filled with metal, and the sheet of metal against the

tangential surface removed therefrom, the balls shall be left for all practical purposes, without sprues, or in a state fit for use. Also, arranging two or more sets of mould plates and their matrices together, so that the matrices of each set shall be made to respectively communicate with those of another set placed either above or below it."

72. For a *Method of Driving Pairs of Reciprocating Saws;* George P. Ketcham, Bedford, Indiana.

Claim.—"Operating the saw sashes by means of the inclined wheel or cam and lever, with its pendents or projections, the parts to be operated being connected to the ends of the lever by rods or pitmen."

73. For an *Improvement in Pump Valves;* Gustavus Hammer, Cincinnati, Ohio.

Claim.—"The manner of connecting the inducting valves of one end of a double or single acting pump with the educting valves at its opposite end, on or to a separate stem or spindle, so that each set of valves may have an independent movement of the other in its operation. Also, the combination of the two educting valves with the inducting valve, in order to give each opening an equal area with a given movement of the valves."

74. For an *Improvement in the Preparation of Paper from Resinous Barks;* Charles E. Hall, Portland, Maine.

Claim.—"The process of preparing paper pulp, using the entire substance of the bark of resinous wood, in which I retain the resinous and gummy matter within the substance of the barks, to act as a size or stiffening for the paper."

75. For an *Improvement in Harrows;* Daniel Haldeman, Morgantown, Virginia.

Claim.—"The so forming and hinging together of the frames or frame pieces of a harrow as that it may be susceptible of adjustment, and so that it may be folded up and rest upon a portion of the frame, which forms a sled upon which it may be conveyed from place to place."

76. For a *Machine for Cutting Tenons;* Joel Hastings, James Ramsey, and Henry G. Chamberlain, St. Johnsbury, Vermont.

Claim.—"1st, The arrangement of the two advancing and retiring tenon heads, the clamping piece, the dog, and the fly. 2d, The construction of the cutter stocks, and arrangement of cutters, substantially as herein set forth, to wit: the cutter stock being composed each of an open flanch, attached by a yoke or arms to its shaft, with a disk bolted to the said flanch, and having the cutters secured one to its face and the other to its back. 3d, The fly."

77. For a *Preparation of Maize-Leaf as a Substitute for Tobacco;* Joseph G. Goshon and Samuel M. Eby, Shirleysburg, Pennsylvania.

"The object of our invention is, the preparation of the leaf of Indian corn in a form similar to the various preparations of tobacco, so that it may be used instead thereof, by persons addicted to the practice of chewing and smoking, with the effect of strengthening the system instead of debilitating it."

Claim.—"Preparing the leaf of Indian corn for the above purpose."

78. For an *Improvement in Apparatus for Separating Zinc White;* Sam. Wetherill, Bethlehem, Pennsylvania.

Claim.—"The combination of the chambers, or their equivalents. Also, the method of effecting the partial cooling of the white oxide of zinc and gases, before they reach the final cooling chamber, by currents of air passing through the hollow spaces in the surrounding walls."

79. For an *Improved Griddle;* Carington Wilson, City of New York.

Claim.—"Constructing the griddle by attaching to the under side of the main plate, by casting or otherwise, the rim or flanch into which is fitted the supplementary plate, in such manner as to form an intervening space or cell."

80. For a *Water Wheel;* Thomas Tripp, Sandy Creek, New York.

Claim.—"So constructing the buckets that the direct surface (of the warped surface bucket,) shall receive the water in a direction normal to a plane parallel to the axis, and the reacting surface combined therewith, having its central line equi-distant from the axis, and at the same distance therefrom as is the central line of the direct surface."

81. For *Self-Regulating Water Gates;* George N. Todd, Dundaff, Pennsylvania.

Claim.—"Having the float attached by a chain or rod to the outer end of a lever which passes transversely through a shaft on the upper part of the flume or penstock, the inner or opposite end of said lever being attached to the gate by a chain by which the gate is raised or lowered to admit the requisite quantity of water to pass through under a variable head."

82. For an *Improvement in Feeding Flour Bolts;* Samuel Taggart, Indianapolis, Ind.

Claim.—"The combination of the annular chamber with its sweeps."

83. For *Slide Rests for Lathes;* Wm. Stephens, Richmond, Indiana.

Claim.—"Attaching the puppet head to the lathe, by having a sector frame attached to the socket or collar, and having an arm at the lower part of the puppet head, the lower end of the arm being secured to the lower end of the sector frame, and the puppet head fitting or working on the arc of the sector frame. The puppet head being operated or moved by a screw rod, or its equivalent, and secured at any desired point on the arc by a set screw, by which the puppet head may be so adjusted as to allow articles to be turned between the centres of the spindle and mandrel, as in ordinary lathes, or the puppet head be used as a slide rest for facing or cutting plates on a chuck."

84. For a *Machine for Cutting Wood into Slivers;* Samuel R. Smith and E. Cowles, Hadley, Massachusetts.

Claim.—"Giving the necessary feed motion to the cutters by means of the lever, with the segment rack attached to one end, which rack gears into the recesses cut in the lower end of the shaft. The opposite or weighted end of the lever being raised by the cord which is wound around a clutch on the shaft, motion being given the shaft by the worm wheel and screw. Also, giving the necessary motion to the cutters while passing over the 'stuff,' by means of the rim or ledge on the disk, said rim or ledge having a bent or curved portion, which, in consequence of the arm working upon it, communicates the proper motion to the cutter stocks, so that the cutters will pass over the 'stuff' in a right or straight line."

85. For an *Improved Air Heater;* William Sage, Durham, Connecticut.

Claim.—"Surrounding the chamber of combustion with series of short annular or segmental air heating compartments, which are combined with series of inclined air inducting pipes, and communicate with the hot air reservoir which surrounds said compartments, by means of the eduction apertures."

86. For *Improved Skates;* N. C. Sanford, Meriden, Connecticut.

Claim.—"Securing the runner to the stock by having disks on the upper ends of the knees, the disks being fitted within tubes or cylinders in the stock, the tubes or cylinders having a suitable elastic material within them, and their upper and lower ends covered by plates secured to the stock, whereby a requisite degree of elasticity is given the skate."

87. For *Improved Skates;* N. C. Sanford, Meriden, Connecticut.

Claim.—"Having the stock of the skate formed of two parts, and connected by a spring, when said stock is combined or used in connexion with an elastic spring runner."

88. For an *Improvement in Hand Cultivator;* J. A. Robinson, Poplin, N. Hampshire.

Claim.—"The instrument for weeding and cultivating plants in rows, the same consisting of the combination of the yoke with the knives."

89. For a *Machine for Manufacturing Hoops;* Jacob Peirson, Alexandria, Virginia.

Claim.—"1st, A vibrating or traversing frame carrying a rotary cutter, so constructed and arranged that the cutter may be made or allowed to plane or cut its full depth, or a proper depth in crooked as well as straight logs, so as to make the hoop or other article formed by the cutter, parallel or nearly parallel with the grain of the wood. 2d, In combination with the frame and cutter, I claim the circular saw, so arranged and operated as to separate the hoop or article formed from the log. 3d, In making the rests or guides which govern the position of the traversing frame, rotating cutter and saw, to traverse on the log, so as to cut the hoop or other article parallel or nearly parallel with the grain of the wood."

90. For an *Improvement in Carriage Windows;* John T. Ogden, Assignor to self and Thomas Goddard, Boston, Massachusetts.

Claim.—"The method of withdrawing the sash through the rear stile of the door, and retaining the door bolted, while the window is partially open."

91. For an *Improvement in Paint Mill;* Charles W. Brown, Boston, Assignor to Geo. W. Banker, Watertown, and George O. Carpenter, South Reading, Massachusetts.

Claim.—"1st, Attaching the trough, which receives the ground paint or material, to the running stone, so that it may rotate therewith, for the purpose of obviating the difficulty experienced in paint mills whose lower stone is the runner, of keeping the paint from running over the sides of the stone, and settling between the stone and the curb surrounding it, where it soon makes a hard bed which produces great friction. 2d, In combining with a paint trough rotating with the runner, a fixed scraper and guards, to cause the paint to flow over and out of said trough, and be guided into any suitable receptacle, whilst the mill continues to run."

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92. For an *Improvement in Piano Forte Frames;* Henry S. Ackerly, City of N. York.

Claim.—"1st, The arrangement of the wrest plank of a square piano forte along the front and across one of the front corners of the instrument, to receive two tiers of strings, of which the tier comprising the longest strings is arranged nearly parallel with the front and back of the instrument, and the shorter one diagonally across the same. 2d, The construction of the metallic plate with the straight brace across the back, and the arched moulding or brace running from the said straight brace to the front of the instrument. 3d, Constructing the plate with a recess to receive the wrest plank, so that it may be firmly secured against the tension of the strings."

93. For an *Improvement in Hotel Annunciators;* John Bale, Buffalo, New York.

Claim.—"1st, The arranging the number-plate upon the sliders, or their equivalents, in combination with the screen plate, so that the number plate shall be pushed forward, lifting the screen plate, and thus exposing the number to view. 2d, The combination of the frame, its hangings and the stops, arm, and lighters, or their equivalents, by which the wires are made to act independently of each other in striking the gong, unless the hammer shall at the instant be in active operation."

94. For an *Improvement in Gas Cooking Stoves;* James B. Blake, Worcester, Mass.

Claim.—"The method of heating the oven of a gas cooking stove, the oven being surrounded by a flue or chamber, having an opening in one end for the admission of air, for the combustion of the gas which is burned immediately beneath the oven and openings in the bottom for the escape of the products of combustion, the latter being retained in contact with the oven until sufficiently cooled to descend and pass off."

95. For an *Improved Anchor Tripper;* Samuel R. Bryant, City of New York.

Claim.—"The supporter, the pawl, and the hold-fast, as arranged in relation to the guard."

96. For an *Improved Mode of Raising Sunken Vessels;* H. V. Corbett, Buffalo, N. Y.

Claim.—"The mode of raising sunken vessels, by means of casks or buoys previously filled with air, and sunk by a weight which is readily detached and raised to the surface after the buoy is secured to the vessel."

97. For a *Method of Adjusting Cylinders in Boring Machines;* William B. Emery, Albany, New York.

Claim.—"1st, The dividing dial and its catch, in combination with the ratchet and pawl, or their equivalents. 2d, The compound dial plate and catches."

98. For a *Method of Adjusting Stuff in Planing Machines;* W. B. Emery, Albany, N.Y.

Claim.—"1st, The bed plate of iron, or other suitable material provided with teeth projecting from it, and adjusted at suitable angles, together with the wedges, or their equivalents. 2d, The bed plate and wedges, in combination with any suitable planing machine."

99. For an *Improvement in Machines for Making Chain Links;* Ammi M. George, Nashua, New Hampshire.

Claim.—"The arrangement of the forked lever confined to the arm, in relation to the inclined plane and former, and operated for relieving the former of the link."

100. For an *Improvement in Repeating Single Barrel Fire Arms;* Daniel B. Neal, Mount Gilead, Ohio.

Claim.—"1st, The combination of the elongated hammer with the false hammer. 2d, The arrangement of the lever and rod for throwing the false hammer forward."

101. For a *Fire Engine;* Amos Nudd, Exeter, New Hampshire.

Claim.—"The method of easing the motion of the brake lever, by the attachment of a crank."

102. For an *Improvement in Rolls and Driers for Paper Making;* Obadiah Marland, Boston, Massachusetts.

Claim.—"The method of making paper machine rolls and driers, a metallic foundation of the requisite strength and thickness being made use of for the body of the roll, upon which a surface of copper or other suitable metal is deposited by galvanic or electric action."

103. For *Improvements in Machines for Making Butt Hinges;* Charles Miller, City of New York.

Claim.—"1st, The arrangement of the punches which cut out two blanks to the proper shape for a hinge, and the bending rollers which give the preparatory bend to the two blanks to form the joint, whereby two strips or bars of metal fed at proper intervals of time towards each other under the said punches and through the said rollers, are cut into blanks bent and put together ready to receive the pin. 2d, Connecting together the two cutters which cut off the two blanks, and arranging and operating the said cutters so that they will cut off the blanks both at the same time, but not until they have both received the preparatory bend to form the joint, and been put together ready to receive the pin. 3d, So controlling the operations of the punches which cut out the metal blanks, the rollers which give the preparatory bend to form the joints, and the cutters which cut off the partly formed hinge from the strips, that all act during each intermission of the feed movement, but that the cutters act more quickly or earlier than the punches, in order that the preparatory bending operation which takes place after the action of the cutters may be effected before the punches are entirely withdrawn from the metal, and that the punches may serve to hold the strips during the said bending operation. 4th, The arrangement of a slider and an intermittently rotating wheel, for the purpose of removing the partly formed hinges from where they are put together and cut off, and carrying them and holding them to receive the pin and have their joints finished, to wit: the said slider working transversely to the direction in which the strips of metal move, to be submitted to the successive operations of punching, bending, and cutting off, and the intermittently rotating wheel being placed on the opposite side of the strips to the said slider. 5th, The arrangement of the wire feeding and cutting apparatus, and the press which carries the closing die, in such a manner that the horizontal intermittently rotating wheel which receives the partly finished hinges when they are cut off, may bring and hold the hinges severally and successively, first opposite the said feeding and cutting apparatus to receive the wire to form the pin, and afterwards opposite the said closing die to have the joint closed. This I claim, irrespectively of the particular means of feeding and cutting off the wire, as almost any kind of feeding and cutting apparatus may be used, and of the particular method of operating the closing die, which may be operated by any of the means commonly employed for such purposes. 6th, The eccentric curved piece, for the purpose of finishing the insertion of the pin in the hinge by pushing into the joint so much of the pin as is left protruding when the pin is cut off, said pushing being effected by the carrying wheel carrying the protruding end of the pin in contact with the said curved piece. 7th, The general arrangement and combination of the several mechanical devices and appliances to form a machine for the manufacture of hinges from bars or strips of metal, complete at one operation."

104. For an *Improved Machine for Shecoring Leather Straps;* Charles Morris, New Haven, Connecticut.

Claim.—"The combination of the knife and gauge with the swinging frame, when this frame is supported by the frame, or its equivalent, to allow this frame to yield to the varying thickness of the strap."

105. For an *Improvement in the Construction of Vessels;* Z. Pangborn, Algonac, Mich.

Claim.—"The arrangement of tanks, constructed as above set forth, the same con-

sisting in the extension and bifurcation of the ribs of vessels' hulls, so as to form an arched series of tanks or receptacles for tanks."

106. For an *Improvement in Propellers;* Franklin Peale, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the paddles, the arms, and the shafts."

107. For an *Improvement in Seed Planters;* R. Romaine, Montreal, Lower Canada; patented in England, May 10th, 1853.

Claim.—"The rotary toothed cylinder, or digger, followed immediately by the seed sower and roller."

108. For an *Improvement in Hot Air Furnaces;* George S. G. Spence, Boston, Mass.

Claim.—"The carrying the smoke discharge flue of the fire chamber back through the fire chamber, whereby the draft of a long flue is promoted. Also, carrying the smoke discharge flue of the fire chamber or radiator back through the fire chamber, in combination with not only providing it with one or more orifices for the discharge of the combustible properties or gases of the smoke into the fire place, but with a diminished opening or passage, sufficient only to carry off the non-combustible volatile portions of the smoke. Also, combining with the discharge pipe and the orifice, the pipe to extend back into the discharge pipe, and with respect to the opening, the same being to facilitate the passage of the combustible gases into the fire place."

109. For a *Tenoning Machine;* William Steele, Wheeling, Virginia.

Claim.—"The arrangement of the feeding box, the rest, and their base with each other, and with the gate which carries the tenoning cutters, in such a manner that the said feeding box may be moved from the said rest upon the base the desired length of a tenon, and then be fed forward again, to bring the joist to be operated upon in contact with the cutters. Also, combining the base of the feeding box and of the rest with the frame, in such a manner that the said base, box, and rest can be secured in an oblique position to the sides of said frame, and to the direction of the movements of the tenoning cutters, whenever it may be desired to form tenons with oblique shoulders. Also, the combination of the incision cutters with the angular-edged cutters, in such a manner that the said incision cutters will penetrate into the surface of the wood in advance of the tenoning cutters a sufficient distance to prevent the said edges of the tenoning cutters from tearing out splinters from the sides of the timber operated upon."

110. For a *Bed Boat or Life Preserver;* Jos. Stevenson, Philadelphia, Pennsylvania.

Claim.—"So hanging the bulk heads or bows to a flexible boat as that they may be turned down out of the way for stowage in the bunks or berths of a vessel, and may be as readily drawn up and laced, so as to form a bow. Also, in combination with the hinged bulkheads or bows, the apron which is drawn up over the joint of the two bulk heads, for the purpose of preventing any water from entering the boat through said joints."

111. For an *Improved Stereoscope Case;* John Stull, Philadelphia, Pennsylvania.

Claim.—"Constructing a stereoscope case with the three jointed pieces, or their equivalents, so applied as to preserve at all times perfect parallelism between that part of the case containing the lenses, and the part which contains the figures, so that a perfect stereoscope is formed of the whole, and the two figures, by binocular vision, are apparently formed into a solid figure, the whole being at the same time adapted to fold or close into a small flat case, (resembling the common daguerreotype case,) that may be conveniently carried about the person, if so required."

112. For a *Machine for Cutting Barrel Heads;* Wm. L. Young, Muscatine, Iowa.

Claim.—"The centrally pressing toothed springs, and also their combination with a disk free to vibrate on its axle."

113. For an *Improvement in Forks for Gold Diggers;* L Teese & Son, San Francisco, California.

Claim.—"Making the forked tines triangular, with one side of the triangle forming the back of the tines, whether applied to more or less number of tines, or length or breadth of fork."

114. For an *Improvement in Corn Shellers;* J. P. Smith, Hummelstown, Penna.

Claim.—"1st, The breast beam, having fluted concave ribs, cross ribs, with openings

or spaces and slides. 2d, The guide frames in separate pieces. 3d, The vibrating feeder, having teeth thereon, in combination with the pulley, having a zig-zag groove."

115. For a *Mandril for Holding Carriage Hubs, &c.;* Hiram Hawley, Rome, N. Y.

Claim.—"The application of the cone-shaped cylinders, calculated for every size of box or hub, and the face end of cylinder to make the revolutions of the set invariable."

116. For an *Improvement in Hemp Brakes;* D. W. Hughes, New London, Missouri.

Claim.—"Arranging and applying the breakers so that they may be brought, while the machine is in operation, to the proper distance apart to suit the nature of the material to be operated upon, and may be caused to approach each other, or nearer to the line of operation of their corresponding breaker, as the operation progresses."

117. For an *Improvement in Looms;* William V. Gee, Assignor to the Atwater and Bristol Manufacturing Company, New Haven, Connecticut.

Claim.—"The method of forming button holes in the process of weaving suspended webbing and other fabrics, by mounting the loom with two or more sets of harness, each governing all the warp threads on one side of the intended button hole, and each set being capable of being lifted and suspended. Also, connecting each set of harness under the before named method of weaving fabrics with button holes, with a bar or slide governed by a cam and catch, or the equivalent thereof, to suspend the operation of either set of harness. Also, in combination with the before described mechanism for lifting and suspending the action of the sets of harness, or any equivalent therefor, the mechanism for determining the period of the suspension of the action of the several sets of harness, or any equivalent therefor."

118. For a *Method of Pumping Water out of Vessels;* Alexander Kirkwood, Jackson County, Mississippi.

Claim.—"The attachment of the above described pump, or of any ordinary force pump, to the bottom of a vessel, so as to force water out at her bottom, thereby avoiding the labor and expense of raising the water above the level of the water the vessel floats in."

119. For a *Spoke Machine;* Asa Landphere, Albion, Penna., and Samuel Rennington, Ilion, New York.

Claim.—"The dressing of spokes, by means of revolving cutters whose edges present an oblique profile in part of the spoke, when said cutters are so arranged on their shafts as to reduce the spoke in narrow longitudinal sections, by which means much more smooth work is obtained than when the cutters reduce the spoke at one single operation."

120. For an *Improved Method of Arranging and Operating Submerged Horizontal Paddle Wheels;* Peter Lear, Boston, Massachusetts.

Claim.—"The pipe, arranged in connexion with the wheel chamber."

121. For an *Improvement in Portable Grain Mills;* C. Leavitt, Quincy, Illinois.

Claim.—"The combination of the bed plate, the legs or supports, the breaker, and the main pivot cast in one piece, and these parts in combination with the lever attached to an external revolving concave."

122. For an *Improvement in Hulling and Cleaning Clover Seed;* Martin H. Mansfield, Ashland, Ohio.

Claim.—"The arrangement and combined operation of the screen, the endless conveyor, and the fan, in such a manner as to enable a strong blast to be employed without wasting the seeds."

123. For an *Improvement in Mowing Machines;* Fisk Russell, Boston, Massachusetts.

Claim.—"The arrangement of the secondary supporting wheel with respect to the main driving and supporting wheel, and the driving shaft, such arrangement consisting in placing the axis of the secondary supporting wheel, aside of, and not in line with, that of the primary wheel, and disposing the secondary wheel back of or on one side of the driving shaft."

124. For an *Improvement in Screw Jacks;* Thomas C. Ball, Walpole, N. Hampshire.

Claim.—"The combination of the tubular screw with the standard and the inner screw."

125. For an *Improvement in Seed Planters;* Andrew J. Barnhart, Schoolcraft, Mich.

Claim.—"The combination of the disks, movable cylinder, and piston, the above parts being inclosed or working within a cylinder or case."

126. For an *Improvement in Spade Ploughs;* David Russell, Drewersburgh, Indiana.

Claim.—"The cutter bars, said bars being provided with cutters at their lower ends."

127. For an *Improvement in Covering Thread with Wool or Silk;* John Haslem, City of N. Y., and James Haslem, Searsdale, N. Y., (sole heirs of Jos. Haslem, dec'd.)

Claim.—"The method of bedding one thread into a roving or loosely twisted thread of another material, as also the covering of one thread by a roving or loosely twisted thread of a different material."

128. For an *Improved Hand Stamp;* Daniel W. Messer, Assignor to self, R. B. Fitts, and Albert James, Boston, Massachusetts.

Claim.—"The india rubber connexion between the plate and the handle."

129. For an *Improvement in Carding Machines;* Horatio N. Gambrill and Singleton F. Burgee, Woodbury Mills, Maryland; patented in England, August 22, 1854.

Claim.—"The application of two or more sets or pairs of feeding rollers to the working cylinder of carding engines. Also, the reversing of the relative velocities of the peripheries of the main working cylinder and stripper at intervals, by an automatic movement, for the purpose of cleaning or preventing the clogging or packing of the main cylinder."

130. For an *Improvement in Fire Arms;* Jehu Hollingsworth and Ralph S. Mershon, Zanesville, Ohio; patented in England, August 1, 1854.

Claim.—"The application of a reservoir of power to the rotating of the cylinder or breech, in combination with the cocking and releasing of the hammer in concert, so as to produce two or more discharges from a repeating fire arm without replenishing said reservoir of power. Also, combining a reservoir of power with a rotating toothed 'scape wheel,' anchor, and trigger, in such a manner that at each periodical releasement of said 'scape wheel,' by the operation of the trigger and anchor, or anchor escapement, the reservoir of power will rotate the chambered breech to the required distance, and simultaneously trip an independent hammer. Also, so combining a rotating chambered breech with a reservoir of power and cock or hammer, as that by the periodical releasement of said reservoir by means of the 'scape wheel,' trigger, and anchor escapement, said chambers shall be caused to rotate to their required distance, and meet the blow of the hammer at the exact instant that each chamber in succession comes opposite the barrel. Also, combining a reservoir of power with an independent cock or hammer, so that by the periodical releasement of said reservoir of power, said hammer shall be tripped at the exact moment that each chamber of the series comes opposite the barrel. Also, so combining the stock with the frame, as that by turning said stock a spring or springs shall be wound up, which shall be capable of actuating the fire arm for a series of discharges. Also, the peculiar form of guard or protection to the hand on which the fire arm may be supported, so as to guard the hand from any accidental discharge of the chambers when not opposite the barrel, whilst said accidental discharge may escape from the fire arm without detriment to the user. Also, the conical plate and ring, as a means by which the stock and spring box are united to the frame, so as to make a firm connexion, and at the same time allow the one to be turned upon the other, for the purpose of coiling up or compressing the spring."

131. For an *Improvement in Repeating Fire Arms;* Ralph S. Mershon and Jehu Hollingsworth, Zanesville, Ohio; patented in England, August 1st, 1854.

Claim.—"1st, A reservoir of power capable of discharging two or more barrels or chambers of a repeating fire arm. Also, exploding the cap, or similar percussion priming for discharging the chamber, by means of the blow caused by the rotation of the chambers or barrels, bringing each nipple or cap in succession against a vibrating arm, or its equivalent, thus causing said rotation to perform the ordinary function of a cock or hammer. Also, so hinging the barrel, or frame which supports it, to the stock, as that when said barrel is swung back or forward, either for removing or recharging the chambers, it will contract the spring to supply a reservoir of power capable of discharging two or more chambers or barrels successively, without re-cocking or re-charging at each discharge."

ADDITIONAL IMPROVEMENT.

1. For an *Improvement in Seed Planters;* J. Graham Macfarlane, Perry County, Pa.; additional to Letters Patent granted March 14, 1854; dated February 6, 1855.

Claim.—"The attaching the box or hopper to the beam and handles, by means of holes left in casting the box, or any equivalent device. Also, in placing the bottom of the lime box below the slide, for the purpose of preventing the lime choking the machine and impeding its action."

RE-ISSUES FOR FEBRUARY, 1855.

1. For an *Improvement in the Mode of Constructing a Combined Cauldron and Furnace, for the use of Agriculturists and others;* Jordan L. Mott, Mott Haven, New York; original patent dated December 1st, 1840; Extended December 1st, 1854; re-issue dated February 6th, 1855.

Claim.—"Combining a cauldron with a portable furnace, having a fire chamber of smaller size than the area of the cauldron, by spreading out and extending the sides of the furnace to form an outer casing, partly or wholly surrounding the cauldron, and forming a flue space between the two leading to the exit pipe. Also, making the casing to form the flue space around the cauldron, by elevating and spreading out the plates of the furnace, and fitting to and combining therewith sectional side pieces."

2. For an *Improvement in Candlesticks;* John W. Rockwell, Assignee of Francis A. Rockwell, Ridgefield, Connecticut; original patent dated Dec. 16th, 1851; re-issue dated February 27th, 1855.

Claim.—"The employment of elastic packing attached to the standard, bar, spring, or slide of a candlestick, whereby I am enabled to support said part, prevent the leaking of the grease, and use a shorter sliding socket than when the cork is inserted loose in the socket."

DESIGNS FOR FEBRUARY, 1855.

1. For *Stoves;* S. W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia, Pennsylvania; dated February 20th, 1855.

Claim.—"The ornaments and mouldings."

2. For *Cooking Stoves;* S. W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia; dated February 20th, 1855.

Claim.—"The ornaments, flutings, and mouldings."

3. For *Daguerreotype Cases;* H. A. Eickmyer, Philadelphia, Pa.; dated Feb. 27, 1855.

Claim.—"The construction of a case for daguerreotype or other purposes, rounded on its front and back edges, and banded."

4. For *Stoves;* John Haufbaner and H. Waas, Cincinnati, Ohio; dated Feb. 27, 1855.

Claim.—"The combination of the different ornaments."

MECHANICS, PHYSICS, AND CHEMISTRY.

Translated for the Journal of the Franklin Institute.

A New Diamond from Brazil. By M. DUFRENOY.

M. Halphem has recently received from Brazil, a diamond very remarkable both for its size and for the perfection of its crystalline form. As soon as it appeared in commerce, it fixed the attention of lapidaries, who, to distinguish it from known diamonds, have called it the *Star of the South.*

The *Star of the South* weighs 52·275 grms., corresponding, in the language of lapidaries, to 254½ carats; by cutting, this diamond will

lose nearly one-half of its weight, and will then be reduced to about 127 carats.

This weight will still place it among the four or five most precious diamonds known.

The Ko-hi-noor weighs from 120 to 122 carats.

The *Star of the South* will, in the opinion of lapidaries accustomed to judge of the water of a diamond while it is yet rough, be perfectly limpid, and will have the peculiar lustre which gives to diamonds so high a value.

The general form of the *Star of the South* is a rhomboidal dodecahedron, beveled very obtusely on each face, and consequently having a solid form of twenty-four faces. The faces are rough as though shagrined. Light striæ in the lines of octohedral cleavage, which distinguish the diamond as a mineral species, are also observable.

Its specific gravity is, according to M. Halphem, 3·529 at 15° Cent.

Upon one of the faces of the diamond is seen a cavity of considerable depth, which may be recognised as due to an octohedral crystal formerly implanted upon it. The interior of this cavity, when examined by a magnifier, shows octohedral striæ; no doubt, therefore, that the crystal which has thus left its trace, was a diamond.

On the posterior part of the crystal, two other cavities of less depth are seen, also bearing the octohedral striæ on their surface; one of these shows traces of three or four crystals. On the same side of the crystal is seen a flat portion, where the cleavage may be seen. I am much inclined to regard it as a fracture; perhaps the point of attachment of this diamond to its gangue, whence it has been detached by the diluvial phenomena which have carried it off.

In addition, I will call attention to some black scales which appear to be titaniferous iron, a mineral frequently associated with crystals of quartz in the Alps and in Brazil.

From all these facts it results, that the *Star of the South* has originally belonged to a group of crystals of diamond, analogous to those of quartz, Iceland-spar, iron-pyrites, and most crystallized minerals. The diamond will then be found lining geodes, in the midst of certain rocks, as yet unknown to us, but belonging, according to the observation communicated to the Academy in 1843 by M. Lomonosoff, to the metamorphic rocks of Brazil. This must be its true position, and in this respect the formation of diamonds will be analogous to that of most other crystals, especially with the formation of geodes seen in the marble of Carrara.

The *Star of the South* was found, at the end of July, 1853, by a negress employed in the mines of Bogagen, one of the districts of Mines-Geraes. It is the largest diamond which has come to Europe from Brazil; the most celebrated diamonds heretofore being from India.—*Acad. des Scien., Paris, January*, 1855.

Translated for the Journal of the Franklin Institute.

New Water-Proofed Stuffs.

The *Societè Philomathique* of Bordeaux, publishes a very favorable report from its Committee, on the water-proof stuffs of M. Fritz Solier.

The tissues of M. Solier are prepared not with natural caoutchouc, but with artificial caoutchouc, of which MM. Barrat have made so many successful applications, and which is prepared by oxidizing drying oils either directly or by aqua fortis. Nothing is more permanent or more workable than this remarkable substance, said to have been discovered by Liebig. To convert it into a material fitted to be used as a coating for stuffs, M. Solier mixes it with a certain quantity of resin-oil, purified by the process of M. Mangeot. The stuffs coated with it are perfectly impermeable, supple, light, and unalterable by light or air; and what is their greatest merit, may be made astonishingly cheap. They are accessible to the poorest classes; and thanks to them, the humblest laborers in our fields will not be exposed hereafter to suffer from the weather. The most delicate silk and the coarsest woolen fabric are alike susceptible of this preparation.—*Cosmos*, vol. v. p. 570.

Translated for the Journal of the Franklin Institute.

On the Mechanical Equivalent of Heat. By M. Person.

The mechanical equivalent of heat, that is to say, the work done by an unit of heat, if there be no loss, has been very differently estimated. M. Mayer found it to be 360 kilogrammètres, M. Laboulaye 110, and M. Joule 427. Lately M. Estocquois, my colleague in the Faculty of Sciences, obtained the number 175, in a Memoir which he had the honor of presenting to you.

We shall have the exact number, when we know exactly the specific heat (c) of air, under constant volume, or rather without external resistance. But, in the meantime, it is perhaps worth while to remark, that the value of c deduced from the formula of Laplace for the correction of the velocity of sound, gives for the mechanical equivalent of heat a number differing very little from that assigned to it by M. Joule.

Air which dilates without external resistance, recovers in a few moments its primitive temperature, and contains, despite its dilatation, neither more nor less heat than before. This principle, as to which doubt might still have been entertained even after the experiments of M. Joule, is now perfectly established by the last experiments of M. Regnault.

Starting from this principle, the mechanical equivalent of heat is deduced by very simple reasoning. Let us consider one cubic metre of air at 0° temperature under the normal pressure (H) kilogrammes per square metre; let p be its weight, c its specific heat under constant volume. If we give to this air the heat pc, without suffering it to dilate, the temperature will rise one degree, and the pressure will become (Ha,) (a being the cofficient 0·00367.) Let us now open a communication with a vacuum; we shall have the same temperature, and the same quantity of heat, in spite of the dilatation, and if the vacuum is equal to the fraction a of a cubic metre, the pressure will become H again.

Let us now take a cubic metre of air, at the temperature 0°, and under the pressure H, c designating its specific heat under constant pressure;

give to this air the heat pc, permitting it now to dilate under the pressure which it supports; we thus obtain a volume Ha at 1° under the pressure H, precisely as in the last case, where, however, we only introduced the quantity of heat pc. In the first case no external work was done, whilst in the second, the dilatation a against the resistance H, produced the work aH. As these two messes of air were identical at the beginning, and are so at the end, neither of them contain more or less heat than the other. We may therefore conclude that the heat $p\,(c-c)$ is *alone and entirely* employed in producing the work aH. Therefore, the work done by an unit of heat is measured by $\frac{a\mathrm{H}}{p\,(c-c)}$.

Substituting the numbers $\mathrm{H}=10334^{k}$ $p=1{\cdot}293^{k}$. $c\left(\frac{279}{333}\right)^{2}=0{\cdot}1686$, according to Laplace, and $c=0{\cdot}2377$, according to M. Regnault; we find 424 kilogrammètres for the mechanical equivalent of heat.

Observe, that $p\,(c-c)$ is the difference of two specific heats for equal volumes. Now, according to Dulong, this difference is the same for all gases, simple or compound. This accords very well with the idea of invariability which attaches to the mechanical equivalent of heat. But, as M. Regnault has demonstrated that a is not rigorously the same for all gases, it follows that $p\,(c-c)$ must vary proportionably by a very small amount. We may, moreover, assume that the specific heats have been measured so far from the point of liquefaction that there is no change in molecular constitution, so that the effects of the heat are confined to variations of temperature, and extraneous work.—*Acad. des Scien., Paris, December*, 1854.

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*Photographic Pictures on Stone for Lithographic Printing.**

In France, the fascinating art of photography has for some time been applied in the process of multiplication by printing on stone, and hence its industrial value has been increased by one great step beyond what we have achieved here. Messrs. Lemercier & Co., of Paris, who have carried this art to great perfection, give the following instructions for practising it. To obtain a photographic picture on stone, in a manner suitable for lithography, a substance must be had which can be placed upon a stone in a regular and uniform film, and which can be acted upon by the light in such a manner that the lights of the picture may be dissolved away and the half tints separated, whilst it must adhere to the stone sufficiently to prevent its being removed either by the solvent or by the subsequent printing process, it being, of course, capable of taking the lithographic ink. The bitumen of Judea, first employed by Niepce, is considered to possess all the requisite properties. It is, however, necessary to select the bitumen very carefully, as some samples are far more susceptible to the action of the light than others. A small quantity of the bitumen, reduced to a fine powder is dissolved in ether, the solution being so made that when it is spread upon the stone it will lie in a

* From the Lond. Pract. Mechanics' Journ., February, 1855.

very thin film, not, however, like a varnish but having a fine grain, and so that on being examined with a magnifying glass the bare stone will be seen in the interstices of the grain. The fineness and regularity of this graining, upon which the excellence of the result materially depends, is obtained by a careful adjustment of the heat of the stone, which should be such as to cause a rapid evaporation of the ether—and by nicety in the preparation of the solution. Whilst the bituminous film is being put upon the stone, it is necessary to avoid all motion of the atmosphere, as caused by the breath or by quick movements of the person, as anything of this kind will make the thickness of the film unequal. When ready, the prepared stone is placed behind a photographic negative on albuminized or collodionized glass, and is then exposed to the light, the duration of this exposure being only ascertainable by practice. If the exposure has been too short, the picture on the stone will be too faint and wanting in the half tints, whilst if the stone is exposed too long a time, the picture will be heavy and devoid of all sharpness and effect. After this, the soluble portions of the bituminous film are washed away by ether, which must be used in excess, otherwise it is very apt to form spots and marks which cannot be got rid of.

When the washing or development of the picture is completed and the stone dried, it is treated in exactly the same manner as a crayon drawing on the stone, that is to say, with an acidulous gummy solution, to clear the whites and increase the transparency of the picture. After this, it is well washed with pure water and essence of turpentine, and it is finally inked with common lithographic ink. If the stone is well prepared it should take the ink at once without any retouching being required, and it will print like a common lithographic stone, the impressions improving as the printing goes on, and the stone will give as many impressions as a common lithographic stone.

Translated for the Journal of the Franklin Institute.

Mode of producing Alcohol from Vegetable Fibre, and especially from Wood. By M. J. Ed. Arnoud.

Under present circumstances, when the manufacture of alcohol is becoming so extensive that it diverts many first materials, especially the cerealia, from their true and more useful employment, I have thought it would be of interest to present to the Academy the results of some researches on a new mode of producing alcohol, although these researches are not yet complete.

Starting from the labors of M. Braconnot, published thirty-five years ago, and upon those more recent, of M. Payen, I undertook to produce a material analogous to starch, sugar, and alcohol, from vegetable fibres, and particularly from wood. My first attempts have fully answered my expectations. I have succeeded, with certain substances, in rendering soluble 97 per cent. of the substances employed, and with certain kinds of wood, in converting into sugar and then into alcohol, from 75 to 80 per cent. of the wood used.

The wood is reduced to coarse saw dust; in this state it is dried up

to a temperature of 100°, (212° Fah.,) so as to drain off the water which it contains, often amounting to one-half of its weight. The wood is then suffered to cool, and concentrated sulphuric acid is poured over it with great care, and very small quantities at a time, so as to prevent the materials from heating. The acid is mixed with the wood as it is poured; then for twelve hours the mixture is let alone; after that it is rubbed up with great care, until the mass, which is at first dry, becomes sufficiently liquid to run. This liquid, diluted with water, is brought to ebullition; the acid is saturated with lime, and the liquid, after filtration, is fermented, and the alcohol distilled in the ordinary way.

In this experiment, the sulphuric acid must be at least 110 per cent. of the weight of the dry wood. Experiments now on hand lead me to hope that the quantity of acid may be considerably diminished; but even now, even with a higher proportion, the manufacture of alcohol would be economical, in consequence of the low price of the matters employed, to wit: wood, chalk, and sulphuric acid.—*Academy des Sciences, Paris, October 23d*, 1855.

For the Journal of the Franklin Institute.

Performance of the U. S. Steamship Susquehanna, during her Employment in the Japan Squadron.

By the kindness of one of the engineers who has been on board of this ship during her entire cruise, we are enabled to present to our readers an abstract of her whole performance, which comprises an amount of steaming probably never before equalled during one cruise by any steamer in the world.

The particulars of the *Susquehanna* were published in this *Journal*, in October, 1852, (vide vol. xxiv., pp. 251–6,) but her principal dimensions may be recapitulated. *Hull*, 257 feet long between perpendiculars, 45 feet beam, 26½ ft. hold, 2452 tons Custom House measurement. *Engines*, two inclined cylinders, 70 inches diameter, 10 feet stroke, poppet valves, Stevens' cut-off gear, arranged to cut off at 5 feet, and not adjustable. *Wheels*, 31 feet diameter, 9 feet 6 inches face, 26 paddles 34 inches wide, average dip, 5 feet to 5 feet 6 inches. Space occupied by engines and boilers in length of vessel, 90 feet. Total, with 900 tons of coal, 102 feet 9 inches in length.

The *Susquehanna* was, for a time, the flag ship of the Japan Squadron, to which she belonged since her departure from Norfolk, in June, 1851, and on which service she has been employed for three years and eight months, having returned to Philadelphia in March, 1855. During her cruise she has circumnavigated the globe under steam, a feat never before performed; has been in motion 340 days, during which the engines were in continuous operation, except for about ten days; has steamed and sailed over 60,000 miles, and has consumed over 11,000 tons of coal. For the whole time during which she was in motion, her mean speed was $7\frac{8}{10}$th knots per hour, with an average hourly consumption of $1\frac{35}{100}$th tons of coal; and the following tables will show the uniformity of results attained during the outward and homeward passages, as well in speed as in consumption of fuel and slip of the wheels:—

Abstract of Log of U. S. Steamship Susquehanna, including her entire performance for the period between her departure from the United States and return to the same, while in service in the Japan Squadron.

DATE.	PLACES.	DISTANCE RUN UNDER			Revols. of Engines.	TIME UNDER									Coal in Tons.
		Steam.	Sail.	Both.		Steam.			Sail.			Total.			
						days.	hs.	min.	D.	H.	M.	days,	hs.	min.	
Dec. 26 to 28, 1850.	Philadelphia to Norfolk.	300	. .	300	26,890	2	19	50	.	.	.	2	19	50	95
June 8 to 25, 1851.	Norfolk to Madeira.	3040	. .	3040	254,788	16	8	10	.	.	.	16	8	10	632
July 5 to 26, "	Madeira to Rio.	2750	1106	3856	205,935	13	19	15	7	0	0	20	19	15	522
September 27 to Oct. 15, "	Rio to Cape of Good Hope.	3598	. .	3598	257,633	17	22	25	.	.	.	17	22	25	487
October 29 to Nov. 15, "	Cape of Good Hope to Port Louis.	2957	. .	2957	219,473	15	19	50	.	.	.	15	19	50	480·5
November 23 to Dec. 2, "	Port Louis to Zanzibar.	1431	. .	1431	102,776	8	2	00	.	.	.	8	2	00	142
December 8 to 28, "	Zanzibar to Point de Galle. Ceylon.	2868	. .	2868	235,222	16	21	25	.	.	.	16	21	25	395·5
January 3 to 12, 1852.	Ceylon to Panang.	1551	. .	1551	130,210	9	2	40	.	.	.	9	2	40	329
January 18 to 20, "	Panang to Singapore.	466	. .	466	31,724	1	18	00	.	.	.	1	18	00	83
January 25 to Feb. 4, "	Singapore to Macao.	1802	. .	1802	148,261	10	00	00	.	.	.	10	00	00	566·5
	Cruising.														
February 28 to May 22, "	" Macao and Hong Kong.	325	. .	325	20,369	1	5	40	.	.	.	1	5	40	81·5
May 29 to June 4, "	" Hong Kong and Amoy.	736	. .	736	51,852	2	7	15	.	.	.	2	7	15	159
	" Hong Kong and Blenheim, &c.	788	. .	788	67 255	2	21	35	.	.	.	2	21	35	166
December 24 to 27, "	" Amoy and Manilla.	636	. .	636	46,822	3	1	8	.	.	.	3	1	8	118
January 27 to 31, 1853.	" Manilla and Hong Kong.	725	. .	725	55,498	3	19	50	.	.	.	3	19	50	165
February 29 to March 5, "	" Hong Kong and Macao.	160	. .	160	10,536	0	16	25	.	.	.	00	16	25	44
March 20 to 27, "	" Hong Kong and Shanghæ.	925	. .	925	85,899	5	9	20	.	.	.	5	9	20	254·5
April 1 to May 19, "	" Yang Tse Kiang.	215	. .	215	4 400	0	18	00	.	.	.	00	18	00	70
May 23 to 26, "	" Yang Tse Kiang & Loo Choo.	466	. .	466	35,371	2	12	00	.	.	.	2	12	00	94
June 9 to 14, "	" Loo Choo and Bonin.	946	. .	946	61,936	5	00	00*	.	.	.	5	0	00	129·5
June 18 to 23, "	" Bonin and Loo Choo.	898	. .	898	68,852	5	8	00*	.	.	.	5	8	00	130·5
July 2 to 8, "	" Loo Choo and Japan.	1019	. .	1019	73,890	6	00	00*	.	.	.	6	0	00	184

July 14 to 25,	1853.	Cruising.	Japan to Loo Choo.	1409	. .	1409	95,449	8	18	0	. .	.	8	18	0	274
August 1 to 7,	"	"	Loo Choo to Hong Kong.	1169	. .	1169	86,700	6	12	0	. .	.	6	12	0	217
		"		250	. .	250	15,994	1	1	40	. .	.	1	1	40	78
January 14 to 21,	1854.	"	Hong Kong to Loo Choo.	1036	. .	1036	80,687	7	12	0	. .	.	7	12	00	216
February 7 to 13,	"	"	Loo Choo to Japan.	865	. .	865	68,754	5	4	15	. .	.	5	4	15	193
February 24 to 27,	"	"	Jeddo Bay.	40	. .	40	4,120				. .	.				15
March 24 to April 2,	"	"	Japan to Hong Kong.	1609	. .	1609	140,360	9	4	27	. .	.	9	4	27	214
April 13 to 18,	"	"		200	. .	200	13,000	0	21	50	. .	.		21	50	49·5
April 20 to 26,	"	"	Hong Kong to Shanghæ.	842	. .	842	78,100	5	0	0	. .	.	5	0	00	233
		"		825	. .	825	57,536	3	3	10	. .	.	3	3	10	178
May 20 to June 4,	"	"		497	. .	497	40,070	4	18	0	. .	.	4	18	00	125
August 1 to 10,	"	"		540	. .	540	139,730	4	15	0	. .	.	4	15	00	125
August 11 to 17,	"	"		200	. .	200	17,230	1	1	15	. .	.	1	1	15	54
September 4 to 15,	"	Hong Kong to Simoda.		1609	. .	1609	122,323	10	18	0†	. .	.	10	18	00	313
September 24 to Oct. 18,	"	Simoda to Honolulu.		3878	. .	3878	285,704	24	1	20	. .	.	24	1	20	555
October 30 to Nov. 12,	"	Honolulu to San Francisco.		2319	. .	2319	181,698	12	0	29	. .	.	12	0	29	476
November 25 to Dec. 5,	"	San Francisco to Acapulco.		1837	. .	1837	150,130	9	19	30	. .	.	9	19	30	363·5
Dec. 12, 1854, to Jan. 1,	1855.	Acapulco to Valparaiso.		3423	. .	3423	295,391	19	21	10	. .	.	19	21	10	700
Jan. 14 to Feb. 4,	"	Valparaiso to Rio Janeiro.		3917	. .	3917	301,018	21	1	55	. .	.	21	1	55	697
February 11 to March 9,	"	Rio Janeiro to Philadelphia.		3984	972	4956	302,405	21	1	0	5	14	0	26	15	11	637
Totals, - -				59051	2078	61129	4,439,991	328	19	49	12	14	0	341	9	49	11041·5
			Outward, - -	20763	1106	21869	1,612,912	112	13	35	7	0	0	119	13	35	3732·5
			Cruising, - -	17321		17321	1,192,410	96	14	50				96	14	50	3567·5
			Homeward, - -	20967	972	21939	1.638,669	118	15	24	5	14	0	124	5	24	3741·5

* *Saratoga* in tow.
† *Southampton* in tow one day.

Abstract of Performances under Steam alone, and assisted by Sail.

	PER HOUR.			PER KNOT.		WHEELS.	
	Speed in knots.	Coal in lbs.	Rev's. of eng'es.	Rev's. of eng'es.	Coal in lbs.	Rev's. per min.	Slip in per cts.
Outward Passage,	7·656	3084	594	77·7	403	9·90	16·5
Homeward "	7·365	2944	575	78·1	400	9·58	17·1
Mean,	7·510	3014	584	77·9	401½	9·74	16·8

In the foregoing table, the performance in cruising has not been included, owing to the short passages, &c., requiring an undue consumption of fuel from lighting and extinguishing fires, &c., and to a want of knowledge of the influence of tides and currents. But the above covers a period of 231½ days, and certainly presents a remarkable economy and uniformity.

We hear much said of the slowness of our naval steamers, of their inefficiency, &c., and as it must be admitted that great cause for complaint has existed, it gives us pleasure to record such a log as the above. The *Susquehanna*, on her return, made the passage from Valparaiso to Rio de Janeiro, *around Cape Horn*, in 21 days and 2 hours, the quickest passage yet made. The run from San Francisco to Philadelphia in 77½ days, of which for 5½ days the ship was under sail and the paddles off; the average speed for that time being about 180 miles in 24 hours. The highest speed attained during any 24 hours, was 251¼ knots.

In considering the above consumption of fuel, it ought in justice to be remarked, that the cut-off was set at half stroke and not adjustable, and that the boilers have for a long time been in a very leaky condition, both of which tended to increase the expenditure of coal. J. V. M.

On the Action of the Violet and Ultra-Violet Invisible Light.

By W. Eisenlohr.*

The phenomenon described by Stokes under the name *fluorescence*, led me to the supposition that this was caused by the interference of the shorter system of waves, blue-violet and ultra-violet (for the sake of shortness, the chemically acting invisible rays of the spectrum may be so designated). I think, with many others, that the eye has the greatest sensibility for a certain duration of vibration, (the yellow light,) and that it is the more sensitive for longer or shorter waves, the more these differ from the medium light in their depth or height.

Light itself consists of the visible systems of waves, and besides these, of such as are longer than red and shorter than violet. As the combination of two tones is always deeper than each single one, out of which the compound tone arises, so from the interference of yellow and blue there can result only light of greater length of undulation, and not violet light. Now, since red has the longest undulations of the visible light, the com-

* From the Lond., Edin., and Dub. Philos. Mag., Feb. 1855.

bination of red and yellow waves of light can only give a deeper tint than red, and consequently no visible light. A fluorescence in the dark space of the spectrum near the red is not therefore to be expected. It is quite otherwise at the other end of the spectrum. The ultra-violet is the light acting in the dark space of the spectrum near the violet; its existence could only be shown by its chemical action, before the wonderful discovery of Stokes. It consists of countless systems of undulations, the lengths of which, differing among themselves, have all a shorter duration than the violet light. Through their interference, waves of greater length than their own results; and by their great variety, tints of combination no less numerous; hence, in many cases, all kinds of visible light, or white.

In other cases a certain color prevails in the mixture of the tints of combination, which will partly arise from the length of the original waves, and partly from the distance of the reflecting layers of atoms of the fluorescent body.*

Starting from this view, I have made experiments to find sources of light in which high tints prevail, in order to test this idea. Violet and blue glasses, through which the sunlight was admitted into the room by means of a heliostat, separating single parts of the entire spectrum from the rest, and causing the light thus obtained to penetrate into the fluorescent bodies, proved, at least, not the contrary of my supposition. I ascribe the cause of the partially slight success to the circumstance, that I possessed no blue and violet glasses of sufficient purity, which on that account allowed fewer of the more intensely acting rays to pass through. At last the violet light occurred to me, which results in the so-called electric egg when it is exhausted of air. I tried its action on fluorescent bodies, and was delighted to see that it produced some of the appearances described by Stokes, with a splendor which I have never seen with the most beautiful experiment by means of the spectrum. Paper on which a design had been made with a solution of sulphate of quinine, showed at a distance of ten to twelve feet from the oval receiver in the dark chamber, all the details of the design in the most beautiful white on a *deep* violet ground. Ruhmkorff's induction apparatus is extremely convenient for the production of the electric light in the receiver, when the latter is almost exhausted of air. The appearance is so striking as to lead to the belief that the writing or design on the paper is itself shining and sparkling.

Hence, in my opinion, it follows, 1st, That the violet light produced *in vacuo* is mixed with a large quantity of invisible ultra-violet rays. 2d, That out of the ultra-violet rays of the so-called northern light invisible to the naked eye, there results by interference in fluorescent bodies a quantity of visible light, and that therefore this light, reflected from the surface of the paper which has been marked with quinine solution, appears brighter than direct light; that therefore, out of the ultra-violet light invisible to the naked eye, there is produced by mechanical means

* Of course, the comparison between the tone of combination, and the light produced by various kinds of ultra-violet or other waves, must not be taken literally, for otherwise the number of vibrations of the resulting color must be equal to the difference in the number of vibrations of the original rays.

actual light. 3d, That the so-called northern light has the strongest chemical action.

A further conclusion is, that the light *in vacuo* of Ruhmkorff's apparatus, or even that of the electric machine, is a much more powerful agent for testing the fluorescence of bodies than any hitherto employed.

I may here mention that I am still engaged on this subject, and reserve to myself further communications. The short time at my disposal compels me to limit myself to the statement, that a thick white glass in the dark chamber appears of a clear and splendid gray.

I scarcely doubt that the white *color* of the electric light in air has also its explanation in the combination of the higher systems of waves, which are formed in consequence of the manifold reflexion on the atoms of air, and the consequent interference. Even the sun's rays are, according to Sondhaus, violet, and we see the sun, as it appears to us, only through a mixture of tints, whose production can be explained by the combination of the shorter systems of rays of the violet light.—*Poggendorff's Annalen*, vol. xciii., p. 623.

On the Incrustation of Steam Boilers. By M. Cousté.*

In the *Annales des Mines* for the present year, is an interesting paper by M. Cousté on the incrustations of steam boilers, and the methods for preventing their formation. He commences by pointing out that the prevention of incrustations, if realized, would produce a better preservation of the boilers, greater security against explosions, and considerable economy in fuel. For steam vessels, it would be attended with an increase of available space for cargo, and the use of steam at high pressure.

He then presents the results of his investigations on the nature of deposits, and the circumstances connected with their formation, whether in boilers fed with salt or fresh water.

M. Cousté suggests four methods for preventing incrustations. The first is, in fact, the well known method, which consists in extracting from the boiler, either at intermittent periods, or in a continuous manner, a certain quantity of water saturated with solid matter. He thinks this process imperfect for low pressure engines, and quite useless for those at high pressure. He proposes, however, to make some further improvements in it, as the greater number of marine steam engines work at low pressure, and may thus be in some measure benefited.

The second of the methods described is called by M. Cousté, *alimentation nonhydrique*, and requires the use of Hall's condensers. The principal objection to this method is the existence of a counter pressure in the cylinder during too considerable a part of the stroke of the piston. By calculation he finds that from about 25 to 30 per cent. of force is lost in a low pressure engine.

The third method consists in continually employing the same water for condensing the steam, and of course requires that this water must continually pass through a refrigerating process.

The fourth method, which belongs entirely to M. Cousté, consists in feeding the boiler with water heated to a very high temperature (at least

* From the London Mechanics' Magazine, January, 1855.

318° Fahr.,) before being introduced into the boiler. This process has the effect of completely precipitating all the calcareous salts held in solution by the water.

The process requires a special heating apparatus, and a filter for separating the precipitate. The author remarks that the filtering which is necessary for engines at ordinary or low pressure, or for high pressure engines working occasionally, might be dispensed with for marine high pressure boilers, because the salts precipitated in the heater cannot again dissolve in the boiler, and consequently cannot crystallize, but will only form a muddy deposit instead of a fixed incrustation.

Finally, in comparing these different methods, M. Cousté thinks the last should be preferred for navigation, whether in salt or fresh water, and exclusively employed for locomotives; while the third more cumbrous method could be advantageously used for land engines under certain locally favorable conditions.

In order accurately to estimate the value of keeping the surfaces of boilers clean and free from incrustation, M. Cousté has mathematically investigated the loss of heat which takes place in causing the water in an incrusted boiler to arrive at a given temperature. He does this by comparing two boilers of the same shape and dimensions, placed under precisely the same conditions, except that one is covered with a calcareous incrustation all over its heated surface, while the other was free from deposit, and covered only with a thin coat of rust. They are supposed to be so managed as to produce equal quantities of steam in equal times. It follows that the heat of the fire under the incrusted boiler must be increased; hence a great loss of heat by the rarefied air and gas escaping through the chimney, and by the external radiation from the furnace. The first of these causes of loss is, of course, the most considerable, and it is it alone that the author has sought to estimate. This he does by the aid of some hypotheses, which enable him to establish his fundamental equations. From these he finally deduces the formula:

$$\frac{\mathrm{II}}{\mathrm{P}} = v\,(1+2\,\mathrm{M}\varepsilon)$$

where II represents the loss of heat in the incrusted boiler due to the causes mentioned, P the loss in the non-incrusted boiler, ε the thickness of the calcareous crust, and

$$\mathrm{M} = \frac{\dfrac{\mathrm{K}}{\mathrm{K}'}\left(1-\dfrac{b}{\mathrm{A}}\right)}{e+\dfrac{\mathrm{K}\,\eta}{\gamma}}$$

in which K is the coefficient of conductivity of the boiler plates, K′ of the calcareous crust; b the temperature of the water in the boilers; A the mean temperature of the heated surface of the non-incrusted boiler; e the thickness of the boiler plates; η the thickness of the coating of rust, and γ its co-efficient of conductivity.

By the aid of these formulæ, the loss of heat occasioned by incrustation in steam boilers covered with deposits not exceeding two-tenths of an inch in thickness, is calculated to amount to 40 or 50 per cent.

That a considerable loss must be produced by boiler incrustation is

thus proved, but it seems to be somewhat exaggerated. One result of these calculations seems, however, to be well established, namely, that the consumption of fuel increases rapidly with every increase in the thickness of incrustation.

M. Cousté makes highly interesting remarks on the nature and formation of the deposits. He distinguishes the deposits of marine boilers from those fed with fresh water. The former consist chiefly of sulphate of lime, and contain not a trace of carbonate of lime, while the latter are formed both of sulphate and carbonate in proportions varying with the localities.

He also distinguishes deposits which are merely muddy, or formed of matters suspended but not dissolved in the water, and which are formed of magnesia, oxide of iron, silica, &c., from the crystalline deposits which commence to form when, during the progress of evaporation, the water has arrived at a state of saturation with respect to the salts forming the deposits.

An important fact resulting from M. Cousté's observations is, that the state of saturation is brought about the sooner the water attains a high temperature; that is to say, that the solubility of the sulphate and carbonate of lime diminishes in a rapid proportion as soon as the temperature rises above the boiling point. Between this and the freezing point, the former of these salts has for temperature of maximum solubility 95° F., and at 212° its solubility is not much greater than at 32°. Hitherto the law of its solubility beyond the boiling point has not been examined; and M. Cousté is perhaps the first person who has shown that at temperatures somewhere about 320°, which corresponds to a steam pressure of four or five atmospheres, the solubility is almost destroyed. Upon this fact is founded the principal method proposed by M. Cousté for remedying the formation of incrustations.

He also explains by this circumstance the difficulties which have hitherto interfered with the use of high pressure engines on board seagoing vessels.—*Journal of Industrial Progress.*

For the Journal of the Franklin Institute.

Stand Pipe of the West Philadelphia Water Works. Reply of H. Howson *to* Birkinbine & Trotter.

As a communication on the above subject from Birkinbine & Trotter, which appears in your *Journal* for March, charges me with deliberate falsehood, a sense of justice towards myself suggests the propriety of an immediate and decided answer. The structure itself is not of so meritorious or formidable a character as to deserve more than a passing notice, and a discussion as to the originality of the design cannot afford much general interest to your readers. I shall, therefore, give my reply in as brief and concise terms as the nature of B. & T.'s communication will allow.

In the first paragraph, they state "that I was employed by them as draftsman for a short time while the stand pipe was in progress of erection, and that the design was made before I was so employed." My answer to this is, that I never was employed by B. & T. as their draftsman, ex-

clusively. I made designs and drawings for them, charging by the hour, at the same time drawing for two other machinists, and attending to my duties as a Patent Agent. I furnished B. & T. with drawings and designs, some executed at my own rooms, some on their own premises, not *for a short time during the erection of the works, as they observe*, but some months before they obtained the contract, and for nearly twelve months afterwards. As for the design of the stand pipe, it was, as I have affidavits to prove, made by myself in my own rooms at Kensington, and obtained from me by B. & T. at a moderate cost, on a distinct understanding that it was to be submitted as mine. This, according to my time-book, took place between the 14th and 30th of December, 1852, and I now have in my possession, some of the original sketches of that design.

In reply to paragraph two, I would observe that the lithograph there alluded to, was made from the above design, the names of B. & T. appearing at the bottom, not as designers of the stand pipe, but as engineers of the water works. The statue of Washington mentioned, was made from a sketch of my own, now in my possession.

As to paragraph three, I beg to state that in no *public print* did Messrs. B. & T. ever make a direct claim to the design of the structure, (not even in the *Gleason's Pictorial* alluded to,) until Nov. 18th, 1854. In the *Scientific American* of that date, it is remarked by the editors that they had received a communication from B. & T., stating that they, and not I, were the designers; the editor concluding with his belief as to the justice of my claim.

A claim, however, was made in public *for* B. & T., by a Mr. Browne, at the laying of the corner stone, in a speech, which gave all the credit of the design to B. & T., and alluded to me as the artist who made all the drawings. From that time, seeing a disposition on the part of B. & T. to deprive me of any credit due, I began quietly to procure affidavits substantiating my claim.

In regard to the large drawing alluded to in paragraph four, all I have to say is, that it was made for B. & T., and had on it at the left hand corner, my name as designer when I last saw it. As to the assertion that I never advanced my claim, if Mr. B. will refresh his memory, he will remember a private conversation on the subject, in which the justice of my claim was not denied, his principal argument being that he *had paid* for the design, and consequently it belonged to him. More than this, I am prepared to show that on several occasions, while I was making the working drawings, Mr. B. himself gave me all the credit, and it was not until my assistance could be dispensed with, that he attempted to deprive me of the same.

Paragraph four concludes with the following remarkable assertion: "Nor were we aware of his having made any claims until we saw the article in the *Engineers and Architect's Journal.*" The utter falsity of this will be apparent from the following. The daily *Ledger*, of Aug. 29th, 1854, contains an account of the stand pipe, giving me full credit for the design. The same paper of Sept. 1st, contains a contradictory paragraph, the authorship of which, by the assistance of the officials at the Ledger office, has been traced to B. & T. The *Scientific American*, of Nov. 4th, 1854, contains an engraving and description,

with my claims fully set forth, and the same paper of Nov. 8th, following, contains the above mentioned remarks by the editors of that paper.

Now, the *Engineers and Architect's Journal* is published in London, and the September number, which contains the article referred to by B. & T., should have arrived in this country about the middle of October; through the loss of the ill-fated *Arctic*, however, the number in question was not received here (at least by the Franklin Institute,) until Dec. 8th, some time after my claim had been urged by myself, and questioned by B. & T. in the above mentioned papers, and yet they have the boldness to assert that they received the first intimation of my claim from this English Journal. So much for these gentlemen's veracity, which the following will not have much tendency to sustain. They say in the *Ledger*, September 1st: "The original design and working drawings of the stand pipe were by Joseph Heindl." In the *Scientific American* they say, that they themselves designed it. Which of these is correct? I say neither.

In paragraph 5, B. & T. imply that I did not make the working drawings of the stand pipe, in support of which assertion they enumerate a series of supposed blunders which they allege I made in the communication above mentioned. Now, there is not a casting about the whole structure of which I did not make the drawings, and sketches of them, with memoranda and dimensions, are now before me; from these was made the large drawing which appeared at the last Exhibition. As to the blunders, let me refer to them *seriatim:*

My answer to No. 1 is, that my sketch calls for a 12 inch pipe, in the base plate, as I asserted. If B. & T. have departed from this, I am not aware of it.

No. 2. My mistake here seems to be that of alluding to all the stone-work as being *cut*, whereas a small portion at the top is covered with iron plates to *represent* cut stone.

No. 3. Contains the *enormous* difference of 4 inches in 20 feet.

No. 4. The working drawing of the stone-work calls for a doorway 8 feet high by 3 feet wide, as I asserted.

No. 5. The stairway *does* terminate in a landing 17 feet across.

No. 6. The spire, including the ball, *is* 9 feet 6 inches high.

No. 7. From the foot to the top of the pipe is 130 feet 3 inches; add to this the height of the spire, 9 feet 6 inches, and we have 139 ft. 9 in., just 3 ins. short of 140 feet. This, I contend, is the correct dimension.

No. 8. The landing *is* 114 feet 8 inches, as given; not 115 ft., as B. & T. insist.

So much for my supposed blunders. How is it, I would ask, that B. & T. say nothing about the accuracy of the numerous other dimensions I gave in the Journal? How is it they did not find fault with the dimensions given in the *Scientific American*, of Nov. 4th?

Even suppose the dimensions given by B. & T. to be the correct ones, I would ask the most sceptical observer if, on reading their remarks upon the same, he would not conclude that I must have been very familiar with the structure to have approximated so closely to their measurements, and that the argument of B. & T. is most weak and inconclusive.

Another paragraph in B. & T's. letter, states that the valve gearing was "adopted from drawings procured from England." I presume they

refer to the treatise on the Cornish Engine, by Pole & Wickstead. I have now before me the plates of these works, as well as a drawing of my own arrangement of valve gearing. That the same principle is involved in them all, is without doubt, otherwise they would cease to be the valve gearing of Cornish engines. My arrangement, however, is very different from that in the illustrations mentioned; so different that it was upwards of two weeks after the design was made that Mr. B. could be brought to understand it thoroughly. As a proof of the novelty of my arrangement, I am prepared to furnish you with drawings and descriptions of the same for publication.

In answer to the paragraph relating to the engines now being erected, I would say that I was introduced to Mr. B. as one familiar with the details of pumping machinery; at this introduction, he told me that he knew nothing about Cornish engines. According to agreement, I prepared him a series of plans which were submitted to Mr. Graeff, before the contract for the works of West Philadelphia was given out. Subsequently, and about the date above mentioned, I furnished him with the design for stand pipe. When B. & T. obtained the contract, I made the working drawings for that building; when these were completed, I made a modified design for Cornish engines with new arrangement of valve gearing of which also I made the working drawings.

In a postscript, B. & T. refer to my affidavits. They are from gentlemen who *do* know the truth of all my statements, and whose integrity no aspersions or sneers of theirs can effect.

In your own remarks, as editor, you state that the affidavits show that I was merely employed by B. & T., with other draftsmen.

The question as to employment is already answered. I would ask who the other draftsmen were? The only parties I ever saw about B. & T's. premises who could come under that denomination, were an apprentice of my own, about 17 years of age, and another youth of about the same age, related to Mr. B., and who, it gives me great pleasure to say, was a successful pupil of my own.

The engineering public are apt to decide upon the merits of such a case as the one under discussion, not by assertions and affidavits of either party, but are rather guided in their decision by the known competency or incompetency of the parties to execute the designs in dispute. Knowing this, I would refer your readers to B. & T's. machinery at the Easton and Germantown Water works, and would ask if men who had been in the habit of constructing such machinery, could possibly engage in the construction of large Cornish engines and ornamental towers, without assistance.

I will conclude by making the following proposition to B. & T.: I am prepared to submit the matter in dispute to the decision of three arbitrators, appointed in the usual manner, with the understanding, that the witnesses on both sides be examined under oath, and cross-examination be allowed. Whatever the decision may be, I pledge myself to abide by it.

I am, yours, very respectfully,

H. Howson.

Camden, N. J., March 24th, 1855.

Translated for the Journal of the Franklin Institute.

Notes on the Differences of Temperature between the Air, the Ground under Snow, and the Ground from which the Snow has been removed. By M. Rozet.

Having occasion to know, for a work which I shall soon have the honor of presenting to the Academy, entitled, "On the Rain in Europe;" the differences which exist between the temperatures of the air, the ground under snow, and the uncovered ground, I profited by the coating of snow which covered Paris from the 20th to the 31st of January.

The following table presents the results of my observations made between noon at 4 o'clock P. M., with three thermometers, one placed under the snow, the other uncovered and placed in a little trough in a space from which the snow had been removed, and the third in the free air:

Temperature of air.	Temperature of ground under snow.	Differences.	Temperatures of ground uncovered.	Differences.
—1°·0	0°·0	—1°·0	0°·0	—1°·0
—2°·0	—0°·5	—1°·5	—1°·5	—0°·5
—3°·0	—0°·5	—2°·5	—1°·5	—1°·5
—4°·0	—1°·0	—3°·0	—2°·0	—2°·0
—4°·5	—1°·5	—3°·0	—2°·5	—2°·0
—6°·0	—1°·5	—4°·5	—2°·5	—3°·5
—6°·5	—2°·0	—4°·5	—3°·0	—3°·5

This table shows that the snow really does protect the soil from a noticeable quantity of cold, since from —1° to —6·°5 in the air, the thermometer under the snow varied only from 0° to —2, and the differences increase from —1° to —4·°5.

The thermometer placed in the trough resting on the soil and uncovered, gave me constantly but one degree of cold more than that under the snow, and consequently differences from that in the air varying from 1° to 3·°5.

When I placed a single sheet of white paper on the thermometer in the trough, I got exactly the same numbers as those given by the thermometer covered with 0·05 inch of snow. It follows that the snow acts only as a screen interposed between the soil and free space, which leads us to believe that the results must be independent of the thickness of the coating which covers the earth. When the earth is uncovered over a small space, the contact of the air and radiation takes from it but 1° of heat. The second column of the table, which gives the increase of cold under the snow in proportion as it increases above, proves that snow possesses considerable conducting and radiating powers.

I give these results to attract the attention of meteorologists to a phenomena which appears to me to have a certain importance.—*Acad. des Sciences, Paris, Feb. 5th*, 1855.

Remarks.—The observations of M. Rozet are undoubtedly important, but we cannot see how they show that the results are not affected by the

thickness of the snow covering. On the contrary, if the conducting and radiating powers of snow be considerable, the greater the thickness, up to certain limits, the less will the earth cool. And our experience in severe winters shows that when the earth is deeply covered with snow, the severest cold of the air scarcely affects its surface, while under a coating of but a few inches, the crust is frequently frozen to some depth. F.

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*Lifting Brick Buildings by Hydraulic Pressure.**

A letter from San Francisco, in the *North American*, says,—They are now grading the streets of the city, filling in some and cutting down others. When the former process is being done, it becomes necessary to raise the houses. You have heard of moving houses entire, but here we lift them up by hydraulic pressure. Whole piles of brick buildings are being raised in this mode where the streets have been filled up, and thus the lower floors are brought up to the new level of the streets. Last week, a warehouse belonging to Alsop and Co., 50 feet front and 70 feet deep, having three stories and a basement, a heavy brick building, was raised 5 feet, and then under-built with stone, all without moving out, or even disturbing the clerks with their pens at the desks! Another store, not quite so large, but having in it 2000 tons of hardware, was raised in six days, and a new story added to it at the bottom.

For the Journal of the Franklin Institute.

Performance of the Cornish Pumping Engines of the Buffalo Water Works.

By Henry Cartwright, Supt. Eng., in construction of the Works.

In preparing for publication in the "*Journal*" a tabular monthly statement of the performance of the two pumping engines of the Buffalo Water-Works, the motive has been, to promote in the United States, a system of recording facts, from every-day operations, of the various branches of the mechanic arts, and to give to them, that publicity, which every one must admit to be, the best means of causing emulation, and consequently bringing them nearer to perfection.

After an examination, into the various plans employed in raising water by steam power, in this country and in Europe, and feeling convinced of the great superiority, and working economy of the Cornish Engine, it was decided upon by the contractors for these works, the late firm of Battin, Dungan & Co. of this city, that they would be the "pioneers," and accordingly settled upon the adoption of the Cornish pumping engines, the first to be constructed in the United States, for supplying a city with water. Since their completion, in December 1851, several other cities, that have been, or are being supplied with water, required to be elevated by steam power, have adopted this class of pumping machinery, and doubtless the demonstrated economy of their performance, will recommend them, over any and all others, in which steam is employed.

The plan of these engines, is known among Cornish engineers, as the "Bull Engine"—the cylinders being inverted over the pumps, and the

*From the Lond. Builder, Nov. 1854.

piston-rod connecting directly to the plungers of the same; thus economizing very considerably in the first cost of the engine and space occupied, as also admitting of a most secure and permanent plan of binding together from the foundation upward, without being subjected to any lateral strain, having a tendency to move the machinery "out of line."—

By a comparison of the following tabular statement, with the reported "duties" of the pumping engines of Cornwall, it will be observed there is still room for improvement; which advantage in the mining engines is readily accounted for, in the incessant working and the great mass of matter put in motion, or momentum acquired, which give an opportunity of using steam of a high pressure (40 a 60 lbs.) and expanding through a very large proportion ($\frac{9}{12}$ a $\frac{1}{12}$) of the stroke—whilst in these engines the load is so light as to preclude the benefits of such high expansive action of the steam, and which are worked with an average of 10 lbs., and a vacuum of 27½ inches and cutting off at half stroke.

The following are the dimensions of the two engines, boilers, and single acting plunger pumps:—

Diameter of Cylinders 50 inches—Stroke 10 feet.
" " Pumps, 24 " " "
4 Boilers—Cylindrical, with internal Firing-flue.
Length of Boilers, 30 feet.
Diameter " " 5 " 6 inches.
" Firing-flue 3 " 6 "
Engine Load, at each stroke lifting 22,012 lbs.

In the statement, there are two colums of "duties," one of which, shows the actual work that the steam performs, and is obtained by the formula adopted by the Cornish engineers—as follows:—

$$\frac{\text{Engine load} \times \text{number of strokes}}{\text{Quantity of coal consumed,}} \times 100 = \text{Duty.}$$

the other showing the quantity of water elevated—as follows:—

$$\frac{\text{Content of pump in lbs.} \times \text{number of strokes} \times \text{by height raised}}{\text{Quantity of coal consumed,}} \times 100 = \text{Duty.}$$

Instead of taking the bushel of coal of 94 lbs, as the unit of duty, as taken in Cornwall, these calculations are based upon the unit of 100 lbs. coal, and which appears to be a more satisfactory basis; as the specific gravity of different coals produces a result in the same ratio.

The fuel used at Buffalo during the time shown in the statement, has been, bituminous coal from Erie, Pa. anthracite coal from the Lackawanna region, near Scranton, Pa. and beach, maple, ash, and some oak wood Wood is now exclusively used and found to be the cheapest, at the advanced price of coals.

It may be proper to add, in reference to the running expenses of the engines or cost of pumping, that it can be shown, these works have produced a more economical result in dollars and cents, than in any other steam works, that have come under our observation—whilst the items, of "repairs of machinery" have been nearly nominal, not exceeding $ 25, since the machinery was accepted from the builders, Messrs. I. P. Morris & Co., of this city, in February, 1852, and for their skill and reputation in the execution and permanence of the work, no more flattering testimonial than this need be offered.

Statement of the performance of the Engines of the Buffalo Water Works.

	Pumping Days.	Number of Strokes.	Pumping time. H.	Pumping time. M.	Strokes per minute.	lbs. coal raising steam.	lbs. coal pumping time.	Total coal consumed.	Gallons raised to reservoir.	lbs. coal per hour pumping.	Gallons raised per lb. coal in pumping.	lbs. water raised one foot high with 100 lbs. coal.	Engine duty.
1852. July,	9	34,554	93	30	6·1+	9,546	16,289	25,835	7,947,320	174	488	33,304,550	46,700,000
" August,	9	29,600	77	06	6·4—	8,737	10,921	19,658*	6,808,000	142	623	42,528,800	60,000,000
" September,	10	37,378	92	00	6·8—	11,467	12,959	24,426*	8,596,940	141	663	45,283,940	63,290,000
" October,	9	32,945	77	47	7· +	11,277	10,298	21,575*	7,577,350	132	736	50,226,900	70,406,000
" November,	18	66,865	145	30	7·6+	19,676	19,844	39,520*	15,378,950	136	775	52,821,030	74,174,000
" December,	10	40,242	86	55	7·7+	11,845	13,479	25,324*	9,255,660	155	687	46,872,870	65,615,000
1853. January,	10	51,216	125	25	6·8+	11,762	17,541	29,303*	11,779,680	140	672	45,840,670	64,421,000
" February,	10	53,860	128	00	7· +	11,919	19,595	31,514*	12,387,800	153	637	43,154,000	60,500,000
" March,	10	52,782	117	35	7·5+	11,714	19,196	30,910*	12,139,860	163	632	43,173,440	60,512,000
" April,	10	53,096	117	20	7·5+	8,730	23,710	32,440	12,212,080	202	515	35,158,500	49,315,000
" May,	10	47,385	104	10	7·6—	7,140	22,685	29,825	10,898,550	218	480	32,800,000	46,000,000
" June,	25	74,871	158	40	7·87	14,275	35,945	40,220	17,229,330	226	479	32,702,000	46,000,000
" July,	24	78,833	166	50	7·87	14,725	35,910	40,635	18,131,590	215	505	34,466,110	48,336,000
" August,	20	103,523	222	00	7·8—	12,700	56,290	68,990	23,810,290	254	423	28,873,880	40,475,000
" September,	20	72,678	154	35	7·8+	13,100	39,700	52,800	16,715,940	257	421	28,760,000	40,300,000
" October,	18	75,417	165	48	7·6—	12,200	39,953	52,153	17,345,910	239	434	29,636,000	41,500,000
" November,	23	101,318	233	40	7·2+	16,100	52,750	68,850	23,303,140	226	443	30,155,300	42,240,000
" December,	18	74,517	167	30	7·4+	13,500	42,400	55,900	17,138,910	253	404	27,592,380	38,450,000
1854. January,	24	99,118	229	06	7·2+	18,600	57,900	76,500	22,797,140	253	394	26,876,560	37,855,000
" February,	23	125,161	294	25	7· +	17,100	66,600	83,700	28,787,030	226	432	29,504,920	41,367,000
" March,	27	142,355	322	23	7·3+	20,500	66,700	87,200	32,741,650	207	491	33,507,850	47,000,000
" April,	22	98,439	236	45	6·2+	16,500	51,700	68,200	22,640,970	218	438	30,000,000	41,912,000
" May,	26	121,548	287	50	7· +	17,600	54,700	72,300	27,956,040	190	511	34,923,000	49,000,000
" June,	25	131,501	314	30	7· —	17,800	65,300	83,100	30,245,230	208	463	31,633,000	44,328,000
" July,	23	119,734	265	35	7·5+	15,800	61,300	77,100	27,538,820	230	449	30,681,000	43,000,000
" August,	23	117,966	261	60	7·5+	16,200	60,000	76,200	27,132,180	230	452	30,900,000	43,566,000
" September,	22	108,234	239	25	7·5+	15,400	54,100	69,500	24,893,820	226	460	31,430,000	44,040,000
" October,	17	81,558	176	00	7·76	11,700	41,300	53,000	18,758,340	235	454	31,020,000	43,470,000
" "	4	19,618	41	15	7·76	9¼ cords			4,512,140				
" November,	22	104,655	227	20	7·7—	65 "	beach, maple,		24,070,650				
" December,	26	140,010	311	25	7·5+	81½ "	oak, and ash		32,202,300				
1855. January,	26	135,846	309	05	7·3+	80⅔ "	wood.		31,244,580				
" February,	23	154,071	348	30	7·4—	88¾ "			35,436,[illegible]3				

* Lackawanna anthracite, from Scranton, Pennsylvania.

In conclusion, I hope that the foregoing may call out other "expositions" that will show to the world, what is "doing in mechanics."

Philadelphia, March 17, 1855.

For the Journal of the Franklin Institute.

Particulars of the Steamer Ocean Bird.

Hull built by J. W. Griffith, New York. Machinery, by Neptune Iron Works, New York. Intended service—For Sale.

HULL.—

Length on deck from fore part of stem to after part of stern post above spar deck,	225 feet.	
Breadth of beam at midship section, above the main wales,	37 "	
Depth of hold,	16 "	
" " to spar deck,	23 "	
Draft of water at load line,	8 "	6 inches.
" " below pressure and revolutions,	8 "	3 "
Area of immersed midship section at this draft,	272 sq. "	
Masts and rig—	Brigantine.	

ENGINE—Vertical beam.

Diameter of cylinder,		65 inches.
Length of stroke,	12 feet.	
Maximum pressure of steam in pounds,	25.	
" revolutions per minute,	19.	

BOILERS—Four—Return flued.

Length of boilers,	2 of 20 and 2 of 22 feet.		
Breadth "	9 "	6 inches.	
Height " exclusive of steam chimney,	10 "	2 "	
Number of furnaces in each,	2.		
Length of grate bars,	6 feet,	6 inches.	
Number of flues,	1st tier, 10,	2nd tier, 5.	
Internal diameter of flues,	" 12. 13, 18,	" 19.	
Length of flues,	" 9 ft. 4 ins.,	" 15 feet, 8 ins.	
" "	" 14 ft. 1 in.,	" 17 " 8 "	
Heating surface,	4475·44 sq. feet.		
Diameter of smoke pipes,	2 of		
Description of coal,	Bituminous.		

PADDLE WHEELS.—

Diameter,	33 feet.	
Length of blades,	7 "	9 inches.
Depth "	1 "	10 "
Number " 28.		

Remarks.—Floor Timbers at throat, *molded*, 12 inches;—*sided*, 10 and 12 inches;—distance of frames *apart*, *at centres*, 20, 21, and 24 inches. Hull strapped with diagonal and double laid iron straps 4 by $\frac{5}{8}$-inch; coppered. Engine and boilers are in a water tight compartment. This vessel is the one generally known as the six-day steamer.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamboat Commonwealth.

Hull built by Laurence & Finches, New York; machinery, by Morgan Iron Works, New York; intended service, New York to Norwich.

HULL.—

Length on deck, from fore part of stem to after part of stern post above the spar deck,	316 feet.	
Depth of hold,	13 "	3 inches.
Draft of water at load line,	8 "	
" " below pressure and revolutions,	7 "	6 inches.
Tonnage, custom house,	1600.	
Contents of bunkers in tons of coal,	30.	

ENGINE—One—Vertical Beam.—

Diameter of cylinder,		76 inches.
Length of stroke,	12 feet.	
Maximum pressure of steam in pounds,	40.	
Cut off at half stroke,		
Maximum revolutions per minute,	19.	

BOILERS—Two—Return flued.—

Length of boilers,	38 feet.	
Breadth "	13 "	6 inches.
Diameter of shell,	11 "	
Height " exclusive of steam chimney,	12 "	6 "
Number of furnaces,	6.	
Breadth of furnaces,	4 feet	2 inches.
Length of grate bars,	8 "	
Number of flues.	10 main and 6 return.	
Internal diameter of flues,	18, 16, and 13 inches.	
Heating surface, (fire and flues,)	5000 sq. feet.	
Diameter of smoke pipes,		56 inches.
Height " "	40 feet.	
Description of coal,	anthracite.	
Draft,	blowers.	

PADDLE WHEELS.—

Diameter,	38 feet.	
Length of blades,	10 "	6 inches.
Depth,		32 "
Number,	28.	

Remarks.—Floor timbers at throat, *molded* 19 in.; *sided*, 6½ in.; distance of frames apart *at centres*, 24 ins. Frame strapped with diagonal double laid iron straps 4 by ⅝-inchs. C. H. H.

Process for Tinning Metals. By MM. ROSELEUR and BOUCHER.*

The authors tin metals by decomposing solutions of certain double salts of tin, especially the phosphate, pyrophosphate, borate and sulphite, by means of the galvanic current. A solution for this purpose is obtained by dissolving 3 kilogrms. of pyrophosphate of potash, and 508 grms. of protochloride of tin, in 200 litres of water. The temperature is raised to about 186° F.; and the bath may be kept saturated with tin by means

* From the London Chemical Gazette, No. 296.

of anodes of tin, by the action of the galvanic current. If it be observed that the bath does not deposit sufficient metal, a certain quantity of chloride of tin may be added to it; this at first forms a white precipitate, which however is again dissolved. A bath of this description, which had been constantly employed for a fortnight in tinning, required no addition of pyrophosphate, so that it might be expected that nothing of the kind would be necessary even for a much longer time. This process appears to be the only one proper for protecting zinc employed in roofing, in sugar moulds, and kitchen utensils, from oxidation.

Cast iron tinned in this manner exhibits a fine silver-like appearance. The fluid for this purpose is prepared with—

Distilled water or rain water,	500 litres.
Pyrophosphate of soda,	6 kilogrms.
Commercial tin-salt,	1 "
Dried and fused tin-salt,	1½ "

According to the strength of the alkaline reaction of the pyrophosphate of soda, which is not always of the same composition, the quantities of the fused and acid tin-salt must be varied. The bath must be kept at a temperature of 168°–186° F. The authors consider this composition to be the best, as its slight alkalinity precludes the disadvantage attending the use of an acid bath, which is favorable to oxidation, whilst it does not, like the strongly alkaline baths, deposit the tin of a bluish color, nor require much washing to get rid of its taste.

At first the authors employed a separate galvanic battery, but it appears that this is only necessary in coating zinc with tin. For other metals it is sufficient to immerse these, previously well cleaned, in the bath, together with some pieces of zinc, when they will be covered with a dull coating of tin in the course of two or three hours. This may be polished with a wire-brush. If the coating of tin is required to be thick, the objects must be immersed several times. The bath may be used almost constantly; it is sufficient, before introducing new objects, to add 300 grms. of pyrophosphate of soda and the same quantity of the tin-salt. The pieces of zinc are gradually dissolved.

The bath employed in tinning zinc has the following composition:—

Distilled water or rain water,	600 litres.
Pyrophosphate of soda,	5 kilogrms.
Dried and fused tin-salt,	1 "

Le Technologiste, 1854, p. 629.

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*Curiosities in Science.**

During a lecture, by Professor Faraday, at the Royal Institute, a piece of pure iron, peculiarly prepared so that its particles might present a large surface to the action of the oxygen in the atmosphere, was ignited, and continued to burn like tinder. The ready combustion of iron compared with gunpowder was shown by a very simple experiment. Some iron filings and gunpowder were mixed together, and sprinkled into the flame of spirits of wine burning on a plate, when the iron filings caught

* From the London Mining Journal, No. 995.

fire and burnt in bright sparks, whilst the gunpowder passed through the flame without igniting; and the quantity that fell on the plate was afterwards dried and exploded. Lead prepared in a similar way was shown to be still more inflammable, for it caught fire in a beautiful flame when exposed to the air. Professor Faraday stated that lead is nearly as inflammable as phosphorus, and he explained the cause of its not burning in ordinary circumstances, to be that the solid product of combustion forms a film that prevents contact with the oxygen, and the conducting power of the other parts of the metal draws off and dissipates the heat. He pointed out the admirable arrangements by which these combustible properties of the metals are kept in proper control, and bodies that are really so inflammable are made to serve as strong resisters of combustion. Professor Faraday next explained the distinction between combustion and explosion, which consists simply in the different rapidity of the two actions, for during the former process the combustible and the supporter of combustion are brought together by degrees, as in the flame of a candle, but in explosions they are both intimately mingled together, and can be brought into action at once. A mixture of hydrogen and oxygen gases, in the proportions in which they are combined in water, was adduced as an example, and a soap bubble blown with those gases was exploded, as an illustration. The cause of the explosion of gunpowder and of other substances that explode without access of air was shown to be owing to the large quantities of oxygen in a solid state that enter into the composition of such explosives, and being intimately mixed with the combustible, afford an instantaneous supply of the supporter of combustion, which enables them in some instances to burn under water. This was illustrated by several striking experiments, including the burning of a marine fuse. Professor Faraday said, that though animal heat is not, generally speaking, caused by combustion, yet the analogy between the processes is so close, that he could not with satisfaction to himself conclude his lectures on the chemistry of combustion without alluding to the subject, and showing the nature of the changes that are going on in the lungs during respiration. He then arranged some experiments to prove the absorption of carbonic acid in the lungs, and he presented on a plate, a mass of charcoal weighing 7 lbs., as representing the quantity that passes from the lungs of a man during every 24 hours. The volume of carbon in the atmosphere, though it contains only one per cent. of carbonic acid, is, he stated, greater than all the carbon that is stored in coal strata in the earth, or spread on the surface of the globe in vegetation.

On the Manufacture and Application of various Products obtained from Coal (Coal-gas excepted.) By Prof. F. Crace Calvert, F. C. S., &c.*

Mr. Crace Calvert commenced his paper by stating that there were two distinct theories by which the formation of coals was explained; and in consequence of the geological influences to which they had been submitted, the coals presented great differences in their composition; as,

*From the Journal of the Society of Arts, November, 1854.

for example, some were entirely composed, as anthracite, of nearly pure carbon, whilst others contained but a small proportion of fixed carbon, and a large proportion of tarry substances or hydro-carbons; such, for example, as cannel, bog-head, and Albert coal, from New Brunswick; and this lead Mr. Crace Calvert to divide coal into three distinct classes, having regard to the distinct applications which they received in manufactures: the first class being employed as fuel in generating steam; the second for making coke; and the third kind chiefly for producing gas. The most valuable researches which had been published upon the composition of coals, and the relative value of different kinds, principally for generating steam, were published in a voluminous report of experimental investigations on coal for the steam navy, by Sir H. De la Beche and Dr. Lyon Playfair, and presented to the House of Commons, by Royal command. The results of those investigations exemplified that most valuable information might be obtained from scientific researches on the relative value of different kinds of this important fuel for generating steam in manufactories, the steam-navy, &c. In fact, the English navy had already derived great advantages from the elaborate researches of the scientific gentlemen before-mentioned, to whom, no doubt, was due the credit of anthracite coal being now extensively used by our large steamers in their voyages to the Cape and Australia. That great improvements were yet to be made in the construction of the apparatus for generating steam, and of economy in the use of particular kinds of fuel, was evident from the fact (mentioned in the report before alluded to) that the combustion of one pound weight of coal in the best constructed boilers of the present day, converted into steam only 10 lbs. of water at a temperature of 212°, instead of 14½ lbs., which was the quantity demonstrated to be practical of realization.

The following Table is an abstract of the researches contained in the report above-mentioned:—

Actual and Theoretical Duty of Coals.

	Practical. lbs. of Water converted into Steam at 212° by one lb. of Coal.	*Theoretical.* lbs. of Water at 212° converted into Steam-coke left.	*Theoretical.* Total lbs. of Water converted into Steam by one lb. of Coal.
Graigola,	9·35	11·31	13·563
Anthracite,	9·46	12·554	14·593
Pentrefelin,	6·39	10·841	13·787
Powel's Duffryn,	10·15	11·134	15·092
Three-qr. Rock vein,	8·84	7·081	13·106
Pontypool,	7·47	8·144	14·295
Ebbw Vale,	10·21	10·441	15·635
Dalkeith Jewel Seam,	7·08	6·239	12·313
Fordel Splint,	7·56	6·56	13 817
Broomhill,	7·30	7·711	14·863
Slievardagh (Irish,)	9·85	10·895	12·482

Another fact ascertained by the researches and experiments of the

same gentlemen, was, that certain kinds of coal were superior for generating steam rapidly, by their quick combustion; while other kinds were better employed for steaming on long voyages, from their slow combustion.

The ordinary kind of coal was, generally speaking, divided into two classes; the best quality being employed for household use, while the inferior was used for generating steam. Great economy had resulted of late years in the use of household coal, owing to the extensive use of coke in manufactures; this class of coal being sifted at the pit's mouth, the small and less valuable part was used for making coke, while the lumps and larger pieces were employed as household fuel.

It was necessary to say a few words on the manufacture of coke. The best coals for making coke were those which would yield from 60 to 75 per cent. of coke, with but a slight trace of sulphur, and which had the property of caking or melting together, so as to form a solid mass in the oven. This superior quality of coal was found near Newcastle-upon-Tyne, and in Lancashire; the best coke being made from what is called "Mountain Mine." These superior cokes were characterized by their high density, the brilliancy of their appearance, and their superior power of generating steam. He had noticed, from long observation of the manufacture of coke, that the best kind was made when three or four feet in depth of coal were introduced into moderately large ovens; allowed to cake for 60 to 90 hours, and cool for 24 hours previously to being drawn.

He had succeeded of late years in discovering a simple process for removing sulphur from coke, thereby greatly enhancing its value for melting cast iron in the cupola, and increasing the bearing strength of the metal. This was proved by the results obtained by Mr. William Fairbairn, and Messrs. Fox & Henderson. The application of the same process to blast furnaces had enabled Mr. Crace Calvert materially to improve the quality of the iron obtained. Mr. Crace Calvert next drew attention to the third class of coals, namely, those employed principally for making gas. These coals, viz., cannel and bog-head, although for commercial reasons Newcastle and other coals of that character are used, were remarkable for yielding in addition to about 30 per cent. of an inferior coke, a large quantity of gas, and numerous other products of greater or less value. The accompanying table would give an idea of the numerous products which chemists had ascertained to exist in the substances distilled from coal:—

Gases.	*Liquids.*	*Solids.*
Bicarburetted hydrogen,	Bisulphuret of carbon,	Naphthaline,
Propyline,	Ammonia,	Para naphthaline,
Light carburetted hydrogen,	Eupion,	Paraffine,
Hydrogen,	Paraffine oil,	Pyrene,
Oxide of carbon,	Aniline,	Chrysene.
Sulphuretted hydrogen.	Leukol,	
	Carbolic acid,	
	Benzine,	
	Napthine,	
	Napthole.	

It will be perceived from this table that the products obtained from

coals were divisible into three classes, namely, gases, liquids, and solids. He did not intend to dwell upon the first class—the gases—which subject was so extensive that it would require to be treated in a separate paper. With respect to the solid products of coal, he would first allude to the coke which was obtained in making gas.

The coke generally obtained from gas-works was very inferior. Great efforts had lately been made to obtain the various products of coal, and also to manufacture good coke for cupola and railway purposes, at the works of the London Gas Company, but he was not aware of the exact results obtained.

The liquid products from coal could be divided into two distinct classes, the aqueous portion and the tarry portion. The aqueous portion was valuable chiefly for the ammonia which it contained, and which was put to the following amongst other uses: In the first place, it was bought by chemical manufacturers, who obtained from it sulphate of ammonia for agricultural purposes, sal ammonia for soldering, and which was also used in calico and print works in the production of a style of prints called "steam goods." From these two salts was obtained hartshorn, which was extensively employed in pharmacy.

Ordinary coal gas liquors was often employed to obtain by distillation common ammonia, which was much used in dye works; also to produce, with lichens, beautiful coloring matters called orchill and cudbear, valuable for the production on silk and wool of delicate purple hues. The production of this color and the influence of ammonia was exceedingly interesting, on the ground that the coloring principle called orcine was colorless until acted upon by the oxygen of the air and ammonia. If to this ammonia a fixed alkali be added, then no more orchill or cudbear was produced, but litmus, which was now much used in chemistry as a test for acids and alkalies.

One of the most interesting and useful of the applications of ammoniacal liquors was in the preparation of ammoniacal alum. The manufacture of this substance had become very extensive of late years. At the chemical works of Messrs. Spence & Dixson, near Manchester, 800,000 gals. of ammoniacal liquor were annually consumed in the manufacture of ammoniacal alum, the ammoniacal liquor being obtained from the extensive gas-works belonging to the corporation of Manchester. The manufacture of this substance, which was so valuable as an astringent, and also to the dyer and calico printer, furnished such a remarkable illustration of the value of chemistry in aiding manufactures and commerce, that he would explain briefly the method of producing it. To obtain this substance called ammoniacal alum, a refuse product of coal pits, known as aluminous shale, was heaped into small mounds and slowly burned. Shale was generally found in hard masses, which fell from the roofs of the coal mines, and the object of burning it was to render it porous and friable. The calcined friable mass was then placed in large leaden vessels, with sulphuric acid, having a specific gravity of 1·65, being the strength in which it was obtained from the leaden chambers. It was a curious fact that this sulphuric acid could be produced from another refuse found in coal mines, namely, pyrites.

The calcined shale and sulphuric acid were heated in these leaden

chambers for about forty-eight hours, the liquor was then drawn off and put into another vessel, into which the ammonia generated from another refuse of coal, namely, the gas liquor, was introduced in a gaseous state. Thus these three substances, the alumina from the shale, the sulphuric acid obtained from the pyrites, and the ammonia from the gas liquor, combined to produce ammoniacal alum, which then only required purifying by successive processes of crystallization to give it that remarkable purity in which it was furnished to the commercial world by Messrs. Spence & Dixson, and other manufacturers.

A great boon would be conferred upon agriculturists if the ammonia which was produced when coke was made in common ovens, were saved, as recommended by Dr. Lyon Playfair, who estimated that every hundred tons of coal would yield, on the average, about six tons of sulphate of ammonia. The quantity of coke made annually in England amounted to at least 1,000,000 tons, yielding, therefore 60,000 tons of sulphate of ammonia, which might be made a cheap and valuable agent in agriculture. When the minimum advantages which manufactures had derived from saving the ammoniacal products in gas-works were remembered, it ought to encourage coke manufacturers and engineers to exert themselves to effect the same. In so doing they would confer a great benefit on the public, as coke would thus be enabled to be sold at a lower price. It was interesting to reflect that, no doubt, at the present day, tons of salts of ammonia were made, where formerly pounds were imported into England, from a district called Ammonia, in Nubia, in Egypt, and which, in the form of salammonia, was derived from heating in glass vessels the soot which had been produced by the burning of camels' dung. The same line of thought might also be applied to alum, which formerly came entirely from the East, then from the environs of Rome, and now, through the application of chemistry to manufactures, the progress of human intelligence, the undaunted perseverance of our countrymen, was manufactured in England from what had been hitherto noxious and refuse products.

Mr. Crace Calvert next spoke of tar. This substance was generally sold to the tar distillers, who obtained from it a volatile fluid called coal naphtha, a light oil, composed principally of carbolic acid and a heavy oil of tar, a solid substance called pitch being also left in the retort. Mr. Crace Calvert then proceeded to state the applicatons which these various materials received. Pitch had of late years been used successfully by the corporation of Manchester in assisting to pave the streets. When the streets were repaved, a large quantity of this pitch, to which was added tar and asphalte, was heated in portable boilers in the street, and was poured, when in a hot liquid state, upon small pebbles or gravel between the interstices of the paving stones, which were thus firmly bound together and became so durable that the most frequented thoroughfares in Manchester, when thus paved, had not required repaving for several years. There was, however, this important sanitary advantage connected with the plan, and to which he wished to draw special attention, namely, that no impure matter and stagnant water could percolate through the impervious pavement and collect beneath, giving forth noxious effluvia, to the injury of the health of the inhabitants of large cities, and even

causing dangerous epidemics. The importance of this process would be the more apparent when it was calculated what a vast surface area was presented by the streets of a large city.

This pitch had also of late been submitted by Mr. Bethell to a further distillation in retorts, which enabled him to obtain a porous, but at the same time a dense coke, and the oils which were distilled in this operation appeared to be such as might be employed to advantage as lubricating agents for common and heavy machinery. Before passing to the various volatile products obtained from the distillation of tar, Mr. Crace Calvert stated, that tar had been applied lately, when mixed with gutta percha or india rubber, to insulate telegraph wires, and to prevent metals from being acted upon by the atmosphere.

One of the first products which came over in the distillation of tar, was a mixture of very volatile hydro-carbons, which had received the name of crude naphtha, and this, when again distilled, was sold under the name of naphtha, and was chiefly burned by the keepers of stalls in streets and markets. When naphtha had been mixed with turpentine, it was called camphine, and was burned in lamps in private dwellings.

When it was intended to apply this naphtha to more particular purposes, it was purified by mixing it with ten per cent. of its bulk of concentrated sulphuric acid, and when the mixture was cold, about five per cent. of peroxide of manganese was added, and the upper portion was submitted to distillation. The rectified naphtha found in the receiver, had a specific gravity of 0·85. This rectified naphtha was used to dissolve caoutchouc for making garments impermeable to water, known as Mackintoshes; and when sulphur was added, and the mixture submitted to steam having a temperature of from 400 to 500 degrees, vulcanized india rubber was produced.

Rectified naphtha was also used for mixing with wood naphtha, to render the latter more capable of dissolving resins for the production of cheap varnishes. When this rectified naphtha had been submitted to a series of further purifications, it had received from an eminent French chemist named Pelouze, the name of "benzine," which had the property of removing with great facility spots of grease, wax, tar, and resin, from fabrics and wearing apparel, without injuring the fabric, its color, or leaving any permanent smell or mark, as was the case with turpentine. Benzine had, through his (Mr. Calvert's) exertions, been introduced into England, and had been found most valuable in brightening velvets, satins, &c. The numerous uses to which this valuable product could be applied in manufactures, must in time render it of extensive employment in place of alcohol and other fluids, which were, generally speaking, too expensive for common commercial purposes. As an instance, he cited that at the present day in Yorkshire there was a large quantity of wool dyed before it was spun, principally for carpet manufactures. It was then necessary to oil this dyed slubbing wool, as it is called, and up to the present time no means had been discovered of removing the oil without injuring the color, and thus this oil remaining in the fabric materially injured the brilliancy of the color, as well as rendered the carpets thus manufactured liable to become sooner faded or dirty. Now, by the employment of benzine, which had not the property of dis-

solving colors, the oil could be removed from such fabrics, and the full brilliancy of the colors fixed on this slubbing wool be restored. He also stated that this benzine could be employed with advantage in photography, in removing the grease from daguerreotype plates. When this benzine was treated with strong nitric acid, it gave rise to a substance called nitro-benzine, which was every day becoming more and more employed as a substitute for essence of bitter almonds, was used for flavoring dishes, and communicating scents to perfumery, soaps, &c. It was interesting to observe that thus, by the triumphs of chemistry, a delicious perfume had been produced from the noxious smelling refuse of coal.

The next products he should mention which were distilled from coal, were those which had the name of light oils of tar, which remain on the surface of water, and which had been applied, conjointly with the heavy oils, with great success by Mr. John Bethell, to the preservation of wood from rotting. Wood which had been treated by Mr. Bethell's process, was extensively employed as railway sleepers, and wherever wood work was exposed to the influence of moisture and the atmosphere. The introduction of the fluid into the wood was effected by placing the wood in close iron tanks, exhausting the air, and then forcing the oil into the whole substance of the wood, under a pressure of from 100 to 150 lbs. to the square inch.

There existed in these light oils of tar a product highly interesting, called tar creosote, or carbolic acid, which possessed extraordinary antiseptic properties; such, for example, as preventing the putrefaction of animal subtances. He (Mr. Crace Calvert) had applied it with success in preserving bodies for dissection, and also in preserving the skins of animals when intended to be stuffed. Owing to its peculiar chemical composition, he had also employed it successfully of late in the preparation of a valuable dye-stuff, called carboazotic acid, which gave magnificent straw-colored yellows on silk and woollen fabrics. The carboazotic acid prepared from the above-mentioned substance could be obtained very pure, and at a cheap rate, thus enabling the dyer to obtain beautiful yellows and greens, which were not liable to fade by exposure to the air, as was the case with most of the yellows and greens which were obtained from vegetable dyes. The advantage of the carboazotic acid, so prepared, was, that it was entirely free from oily or tarry substances, which had the property of imparting a disagreeable odor to the dyed fabric. The intense bitter which this acid possesses had induced him to have it tried as a febrifuge, and Dr. Bell, of Manchester, had succeeded in curing several cases of intermittent fever by its aid, in the Manchester Infirmary. He had also placed some of this substance in the hands of eminent physicians throughout the country, and he hoped shortly to ascertain that it was of real value as a substitute for that expensive medicine, sulphate of quinine.

He had lately applied carbolic in a manner that offered advantages to dyers and calico printers. It was well known that extracts made from tanning matters could not be kept for any length of time without undergoing deterioration, in consequence of the tanning matter which they contained becoming decomposed, and transformed, by a process of fer-

mentation, into sugar and gallic acid; which acid, he had ascertained, not only had no dyeing properties, but that, on the contrary, it was injurious, from having a tendency to remove the mordants which were employed to fix the colors on the cloth. It was also known that gallic acid possessed no tanning properties. By adding a small quantity of carbolic acid to the extracts of tanning matter, they could in future be kept and employed by the dyer as a substitute for the substance from which they were obtained—by which would be gained the double advantage of saving labor, and obtaining a better effect from the tanning matters.

The third substance which passed off in the distillation of tar was called heavy oil of tar, which was used by Mr. Bethell as above stated. This substance contained a singular organic product, first discovered by Dr. Hofmann, of London, and called by him "kyanol" or "aniline," which possessed the property of giving, with bleaching powder and other agents, a magnificent blue color. This fact led him (Mr. Calvert) to observe that this last mentioned substance, as well as carboazotic and indigotic acids, being produced as well from indigo as from coal-tar, proved the great similarity and chemical connexion which existed between the products of tar and those of indigo, and induced him to believe it extremely probable that those products would be employed within a few years as substitutes for indigo and madder. Laurent had succeeded in obtaining two products from naphthaline which had a great analogy to the coloring principles of madder. A substance, for instance, called chloronaphthalic acid had the same composition as the coloring matter of madder, and would be identical if the hydrogen gas was substituted for the chlorine which the acid contained. Hence the chloro-naphthalic acid had the property of giving with alkalies a most superior red color.

When the coloring principle of madder was treated with nitric acid, a substance called alizaric acid was obtained, which was identical with a substance also obtained from naphthaline called naphthalic acid. Naphthaline was a solid white substance, which distilled in large quantities during the distillation of tar.

An interesting fact had been discovered by Mr. James Young, of Glasgow, namely, that if coals were distilled at a low temperature, the products obtained were different from those which were produced when coals were distilled at a high temperature, as was the usual custom in the manufacture of gas. Without entering into all the details on this point, he would mention one of the most striking differences of results, namely, that Mr. Young obtained in place of the naphthaline, a valuable lubricating agent, called paraffine, a solid substance, and a large quantity of carburetted hydrogens were also distilled, which, being free from smell, were valuable for commercial purposes, and had received the general name of paraffine oil; or, as Dr. Lyon Playfair remarked in his report of the Great Exhibition of 1851, it was "liquified coal gas." This paraffine oil, when mixed with other oils, was now most extensively employed in the cotton-mills of Manchester and the neighborhood. Solid paraffine was also obtained in the distillation of peat, and was employed for manufacturing candles, there being added to it about 20 per cent. of

wax. These candles were remarkable for their transparency and the pureness of their flame. Mr. Crace Calvert exhibited specimens of these candles, and of the various substances mentioned in his lecture, and by which he had illustrated his remarks throughout, and exemplified the truth of his facts and statements. He stated that he was indebted to Mr. Edward Binny, of Manchester, for the collection of coals which were on the table, and to Mr. Clift for most of the valuable specimens of products obtained from coal-tar.

To be Continued.

For the Journal of the Franklin Institute.

Particulars of the Steamer Ariel.

New York.—Hull built by J. Simonson, New York. Machinery by Allaire Works. Owner, C. Vanderbilt. Intended service, New York to Liverpool.

HULL.—

Length for tonnage,	240 feet.	
Length on deck,	250 "	
Breadth of beam at midship section,	33 "	6 inches.
Depth of hold,	19 "	
" " to spar deck,	26 "	
Draft of water at deep load line,	14 "	
Tonnage, custom house, 1300.		
Area of immersed section at 14 feet,	440 sq. feet.	
Contents of bunkers in tons of coal, 600.		
Masts and rig— foretopsail schooner.		

ENGINE—one vertical beam.—

Diameter of cylinder,		75 inches.
Length of stroke,	11 feet.	

BOILERS—two return flued.—

Length of boilers,	32 feet.	
Breadth "	12 "	6 inches.
Diameter of shells,	11 "	2 "
Height " exclusive of steam drum,	11 "	8 "
Number of furnaces in each, 3.		
Breadth of furnaces,	3 feet	6 inches.
Length of grate bars,	7 "	6 "
Number of upper flues, 6.		
Internal diameter of upper flues,		17¼ inches.
Length of flues,	27 feet.	
Diameter of smoke pipes,	6 "	2 inches.
Height " "	48 "	
Description of coal, anthracite or bituminous.		
Draft, natural.		

PADDLE WHEELS—ordinary radial.—

Diameter,	33 feet.	
Length of blades,	8 "	
Depth "	1 foot	6 inches.
Number " 28.		

Remarks.—Hull strapped with diagonal and double laid straps; planks edge-bolted. Floor timbers, *molded* 16 ins.; *sided* 12 ins.; apart at *centers* 24 ins.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer William Jenkins.

Hull built by John A. Robb, Baltimore; machinery by Murray & Hazlehurst, Baltimore. Owners, Merchants and Miners' Transportation Company of Baltimore. Intended service, Baltimore to Boston.

HULL.—

Length on deck,	205 feet.	
Breadth of beam at midship section,	31 "	
Depth of hold,	9 "	
" "	10 "	6 inches.
Draft of water at deep load line,	13 "	
Tonnage, custom house,	1000.	
Masts and rig—	schooner.	

ENGINES—

Diameter of cylinder,		56 inches.
Length of stroke,	9 feet.	

BOILERS—two—tubular.—

Draft,	natural.

WATER WHEELS.—

Diameter,	26 feet.	
Length of blades,	8 "	6 inches.
Depth "	1 "	10 "
Number "	22.	

Remarks.—Floors *molded* 18 ins.; *sided*, 8 ins.; distance apart *at centres*, 27 ins. C. H. H.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, March 15th, 1855.

John C. Cresson, President, in the chair.

John Agnew, Vice President,
John F. Frazer, Treasurer,
Frederick Fraley, Corresponding Secretary,
Isaac B. Garrigues, Recording Secretary,
} Present.

The minutes of the last meeting were read and approved.

Letters were read from the Institute of Actuaries of London and Ireland, and the Statistical Society of London, and the Big Spring Literary Institute, Newville, Pennsylvania.

Donations to the Library were received from the Royal Astronomical Society, and the Chemical Society, London; the Massachusetts Charitable Mechanic Association, Boston, and W. Jackson, Esq., Newton, Mass.; the Regents of the University of New York, Albany, and J. S. Dodge, Esq., Rome, N. York, Charles B. Norton, Esq., and Prof. S. F. B. Morse, City of New York; John McRea, Esq., Charleston, S. Carolina; Geo. W. Kendall, Esq., and the Young Men's Mercantile Library Association, Cincinnati, Ohio; the Kentucky Mechanics' Institute, Louisville, Ky.; the Mercantile Library Association, St. Louis, Missouri; the University of Michigan, Ann Arbor, Michigan; E. G. Waterhouse, M. V. Baker, and R. M. Foust, Esqs., Pennsylvania Legislature, and State Librarian, Pa.; Messrs. Charles Oat, and A. B. Hutton, Drs. Chas. F. Beck, and A. L. Kennedy, and the Directors of Girard College for Orphans, Philada.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for March, was read.

The Actuary reported the organization of the Board of Managers, and the following Standing Committees for the ensuing year, by the election of their chairman, and appointing the time for holding their stated meetings, as follows:

Board of Managers, { Isaac S. Williams, Chairman, / T. J. Weygandt, / Owen Evans, } Curators. } 2d Wednesday Evening.

Committees.

On the Library,	George Erety, Chairman,	1st Tuesday	"
" Models,	George C. Howard, "	1st Thursday,	"
" Exhibitions,	John E. Addicks, "	" "	"
" Min's. and Geo. Specm's.,	J. C. Trautwine, "	2d Monday	"
" Meetings,	Fairman Rogers, "	" "	"
" Science and the Arts,	John C. Cresson, "	2d Thursday	"

The Board of Managers and Standing Committees reported their minutes.

The Committee on the Library reported that 322 volumes, together with a large number of pamphlets, had been added to the Library during the past year.

The candidates for membership in the Institute, (5,) were proposed, and the candidates proposed at the last meeting, (5,) were duly elected.

Dr. Rand exhibited an improved galvanometer invented by Mr. Thos. J. Weygandt. Its peculiarities consist in the arrangement of the pole-changers of the helix, which is moveable in an horizontal plane, without altering the direction of the needle; there is also an arrangement by which the needle may be raised or lowered without altering its direction, or may have its direction altered without change in its position in a vertical plane. The instrument is exceedingly delicate. It is at present under consideration by the Committee on Science and the Arts, and a detailed description will be published in a future number of the *Journal.*

Dr. Rand also exhibited some illuminating gas, made from wood in the retort patented by Dr. C. M. Cresson. This process is now in use